THE
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OCTOBER, 1909

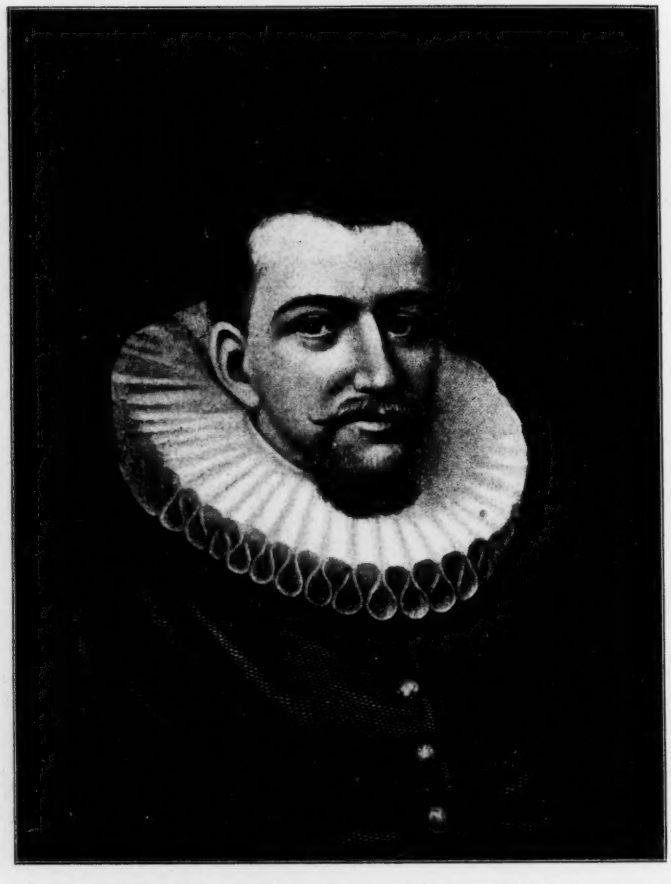
THE HUDSON-FULTON CELEBRATION OF 1909

By Dr. GEORGE FREDERICK KUNZ
NEW YORK CITY

SINCE the London Exhibition of 1851, and the first Paris Exposition of 1855, there have been probably one hundred expositions in various parts of the world. Generally they have been held in commemoration of some historic event or anniversary, and each one, large or small, has usually had some special distinctive feature. The great exposition at Chicago had its White City and its illuminations; the Buffalo Exposition had its architecture, its illuminations and the added advantage of its striking environment, and the various French expositions have each possessed peculiar points to mark their individuality. All of them have been held for six months or more, but in a great many cases from one third to one half of that time elapsed before all the departments were completed and opened to the public. In this way public interest was checked at the beginning, and when the exposition was finally completed, a good part of the allotted time had passed, and the enthusiasm always excited by these affairs had begun to flag.

New York in itself is not only the greatest exposition, perhaps, in the world, because of its geographic features and its wonderful resources, but its various lines of transit—surface cars, elevated railways and subways—facilitate the handling of great crowds. In addition to this New York lies between two rivers, and is as easily reached by boat as by rail, to say nothing of the attractive physical advantages this location gives it.

The writer, in an article published in the *North American Review* for September, 1902, and entitled "The Management and Uses of Expositions," strongly urged the holding of an exposition to mark the tercentenary of Henry Hudson's arrival at the mouth of the river which bears his name. The forecast of the present advantages of our city

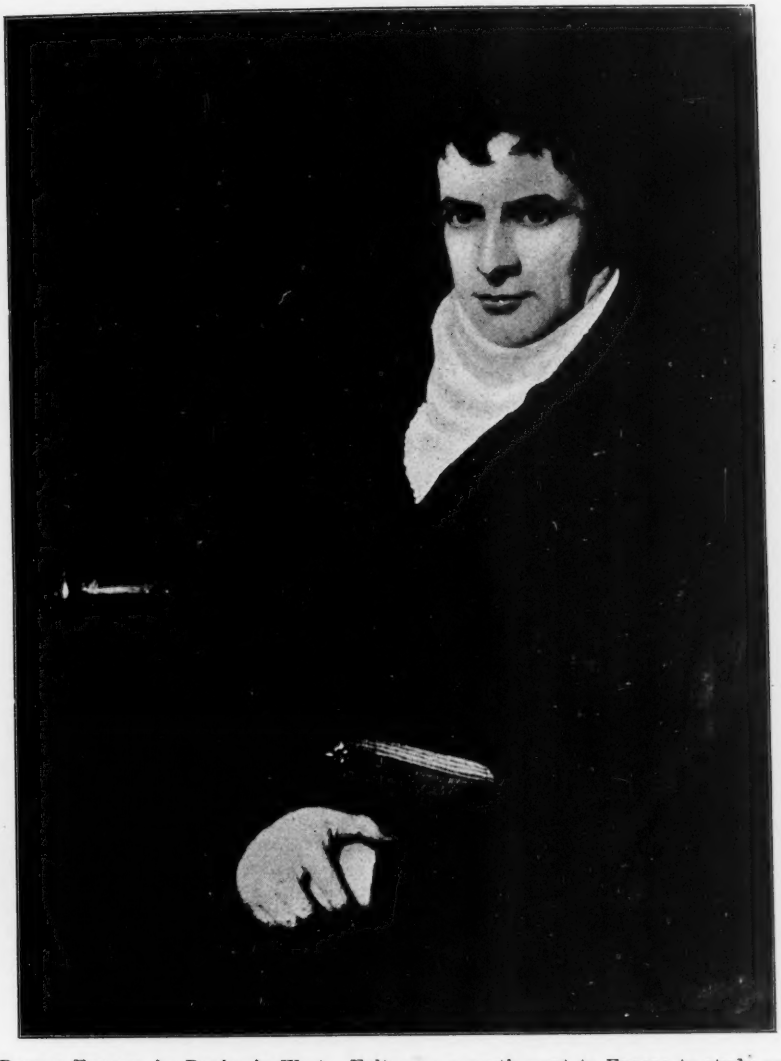


HENRY HUDSON (ideal). No artist's name attached.

given in this article has been almost literally fulfilled, and the writer realizes more than ever that he was correct in saying that the museums and institutions of our city would "furnish a greater display to the visitor than any exposition yet held on the continent."

New York, with its great variety of public buildings, its miles of waterways, its dozens of museums, its many civic buildings, its great system of parks, stands alone as a prominent and fitting exposition ground. Why erect a city of staff, wood and other inflammable material to hold costly objects? Whoever contributed his much-prized works of art to such shelter, awaited, with fear and trembling, their safe return, and few of the finest things were ever loaned except in Paris, where they were shown in permanent structures such as the artistic Nouveau Salon, and its dainty neighbor, the Petit Salon, to the right of which is the magnificent Pont Alexandre II.

Although not so named, this Hudson-Fulton Celebration really presents the features of a great exposition, for when all the resources



ROBERT FULTON, by Benjamin West. Fulton as a youth went to Europe to study art. West was his teacher. This portrait of Fulton is said to represent West's best style. Hudson-Fulton Celebration Commission.

of New York are presented as they will be on this occasion, and given a brilliant and attractive setting, it will be found that no exposition ever organized on this continent has offered a greater variety of interest. To apply the standard of monetary value may seem a trifle vulgar when we are treating of the triumphs of art in all its forms, and yet this standard merely expresses the worth of antiquities and artistic creations in a more exact way than by using superlatives of speech. A reasonable estimate of the value of the attractions that our city offers to its visitors would be rather in excess of $2,000,000,000 than below that figure, and

LAST DAYS OF HENRY HUDSON, by Sir John Collier. Original in Tate Gallery, London. On his last voyage (in the *Adriatic*) Hudson was set adrift in a small boat by his mutinous crew and nothing was later heard of him. Hudson-Fulton Celebration Commission.

yet, where the great expositions of the past have cost from $10,000,000 to $20,000,000 or more for their organization, all the treasures and beauties of New York can be displayed at an expense of only $1,000,000. A single building, the Metropolitan Museum of Art, with the objects it will hold, would not be over-valued at from $30,000,000 to $40,000,000.

At an exposition the public is called upon to pay fifty cents admission each time to enter the gates and an additional fee for each special exhibition. The great New York celebration will be free for all, even for those who have no car fare to enable them to ride. The demonstrations are in the heart of the city itself. They do not take place in some suburb, or barren, out-of-the-way spot. They are not encompassed

within a temporary city built like that at Coney Island, or held away out in the Bronx, on the Palisades or at Staten Island; neither is the celebration instituted or furthered to boom any special piece of real estate, or to sustain the selling of a quantity of traction stock or railroad stock that might be affected by an unusual traffic for the time being.

The celebration is designed to cover a very wide field, and the aim of the commission has not been confined to honoring the explorer of the Hudson River and the man who made steam navigation a permanent success; in addition to this the occasion has been utilized to illustrate and emphasize the development and greatness of New York City, the metropolis of the western hemisphere. Those who can understand the true significance of this celebration, and who are able to forecast the future, will see the vision of a still greater and more magnificent city, worthy of being called a world metropolis.

Although the naval parade owes its greatness to the presence of the American and international war fleet, and to the immense aggregation of vessels of all kinds and denominations assembled for the occasion, the place of honor is fittingly assigned to the replicas of the two small vessels which helped to make the names of Hudson and Fulton famous. The reproduction of the *Half Moon,* generously offered by the government of the Netherlands, is a craft of but 80 tons burden and is only 74½ feet long and 17 feet wide. The *Half Moon* will be under the command of Commander Lam, who will be costumed to impersonate Henry Hudson; the crew will also wear the dress of sailors of Hudson's time. A comparison with the *Celtic* shows in a striking manner the wonderful progress in naval construction, the giant liner being 700 feet long and 75 feet wide, while its tonnage is 20,904. The historic *Clermont,* which, in 1807, made its memorable trip up the Hudson, thus inaugurating steam navigation on the river, has been carefully reproduced. This craft, while larger than the *Half Moon,* is still small and insignificant in comparison with the magnificent steamers of to-day. It is only 150 feet long and 18 feet wide.

The reproductions of the *Half Moon* and the *Clermont* constitute the central point, the very focus, of the celebration, and this has been fully recognized by the commission. Hence the opening day, Saturday, September 25, will be devoted to a grand naval parade, perhaps the greatest naval pageant ever seen. The eighty warships, American and foreign, form the most imposing array of naval forces assembled at any time in the new world, and we may safely say that, with one or two possible exceptions, no fleet of equal might and numbers was ever brought together.

The United States will be represented by 16 battleships, 12 torpedo-boats, 4 submarines, 2 supply ships, 1 repair ship, 1 torpedo vessel, 1 tug and 7 colliers: 53 vessels in all, the battleships constituting the

most powerful fleet ever assembled except on a few occasions in the English Channel. Rear-Admiral Seaton Schroeder, U.S.N., is in command.

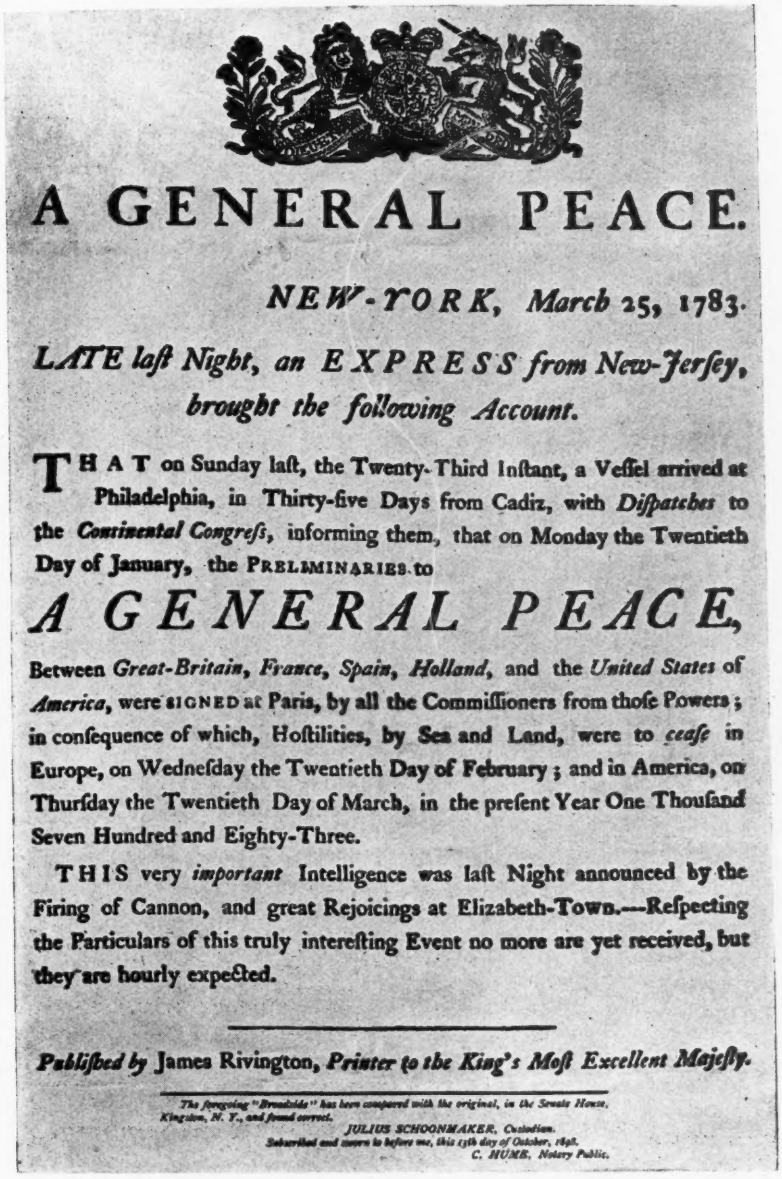
From the Netherlands comes the cruiser *Utrecht,* commanded by Captain G. P. van Hecking Colenbrander, R.N.N., and the replica of the *Half Moon.* Germany sends the cruisers *Dresden, Hertha, Viktoria Luisa* and *Bremen,* under the command of Grand Admiral H. L. R. von Köster, retired, of the Imperial Navy. The English squadron will con-

THE PURCHASE OF MANHATTAN ISLAND.

sist of the cruisers *Inflexible, Drake, Argyll* and *Duke of Edinburgh,* commanded by Admiral Sir Edward Seymour, of the Royal Navy. France will be represented by two battleships, the *Liberté* and the *Justice,* under the command of Vice Admiral Le Pord. From Italy come the cruiser *Etruria* and the schoolship *Etna,* on board of which will be the cadets of the Royal Naval Academy—the future officers of the Italian navy.

Latin America will also participate in the parade, Mexico being represented by the gun-boat *Bravo,* commanded by Captain Manuel E. Izaguirre; Cuba, by the revenue-cutter *Hatuey;* the Argentine Republic, by the warship *Presidente Sarmiento,* and Guatemala, by a coast-patrol boat.

An immense fleet of seagoing and coastwise merchant vessels, steamboats, ferryboats, steam yachts, motor boats, tugs and steam lighters, sailing crafts, police boats, wrecking boats, fire boats, hospital boats, naval-militia vessels, steam cutters and launches, United States revenue-cutters and other craft, including the *Clermont* and *Half Moon,* will assemble in ten squadrons in the Harbor, in the vicinity of the Brooklyn,



A GENERAL PEACE.

NEW-YORK, March 25, 1783.

LATE laſt Night, an EXPRESS from New-Jerſey, brought the following Account.

THAT on Sunday laſt, the Twenty-Third Inſtant, a Veſſel arrived at Philadelphia, in Thirty-five Days from Cadiz, with *Diſpatches* to the *Continental Congreſs*, informing them, that on Monday the Twentieth Day of January, the PRELIMINARIES to

A GENERAL PEACE,

Between *Great-Britain*, *France*, *Spain*, *Holland*, and the *United States* of *America*, were SIGNED at Paris, by all the Commiſſioners from thoſe Powers; in conſequence of which, Hoſtilities, by Sea and Land, were to *ceaſe* in Europe, on Wedneſday the Twentieth Day of February; and in America, on Thurſday the Twentieth Day of March, in the preſent Year One Thouſand Seven Hundred and Eighty-Three.

THIS very *important* Intelligence was laſt Night announced by the Firing of Cannon, and great Rejoicings at Elizabeth-Town.—Reſpecting the Particulars of this truly intereſting Event no more are yet received, but they are hourly expected.

Publiſhed by James Rivington, *Printer to the King's Moſt Excellent Majeſty.*

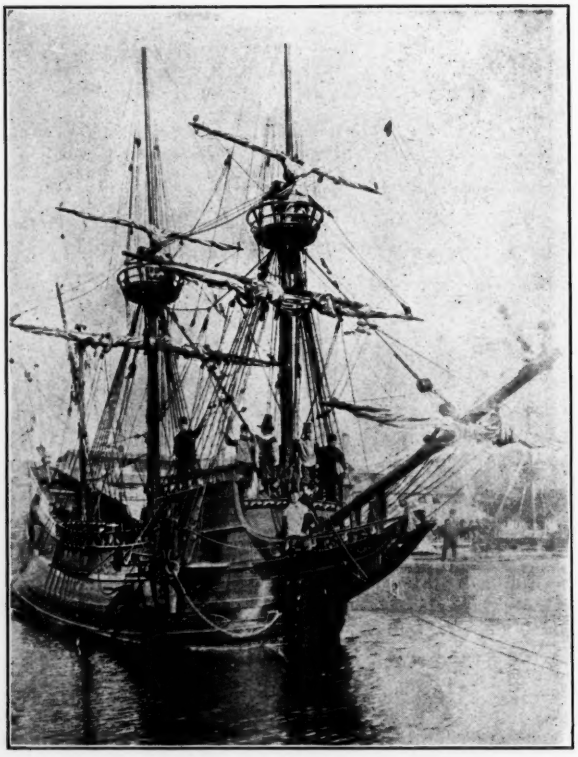
The foregoing "Broadside" has been compared with the original, in the Senate House, Kingston, N. Y., and found correct.

JULIUS SCHOONMAKER, Custodian.

Subscribed and sworn to before me, this 15th day of October, 1898.

C. HUME, Notary Public.

Staten Island and New Jersey shores. An object of interest for all will be the historic *Roosevelt,* used by Commander Peary in his successful trip to the North Pole. Staten Island has contributed a reproduction of Commodore Vanderbilt's periagua, the forerunner of the Vanderbilt ferryboats between Staten Island and Manhattan. The warships will also rendezvous in the harbor, and at 1:30 P.M. the parade will begin, the warships in the lead. The whole array of vessels, at least seven miles in length, will advance, slowly and majestically, up



THE HALF MOON. An exact photograph of the replica of the *Half Moon*, in which Hudson sailed under the auspices of the Dutch East India Company, built by patriotic citizens of Holland and to be presented to the Commission. Hudson-Fulton Celebration Commission.

the Hudson River. When the head of the column reaches Forty-second Street, the two leading warships will swing out of line and cast anchor opposite each other; a little further on the second pair will then perform the same evolutions, to be succeeded in turn by all the other warships, the line finally extending from Forty-second Street to 175th Street. The civic fleet will continue on its way, passing to the left of the warships until the head of the line is reached, when the vessels will cross over and move down the river between the warships and the Manhattan shore, to 110th Street.

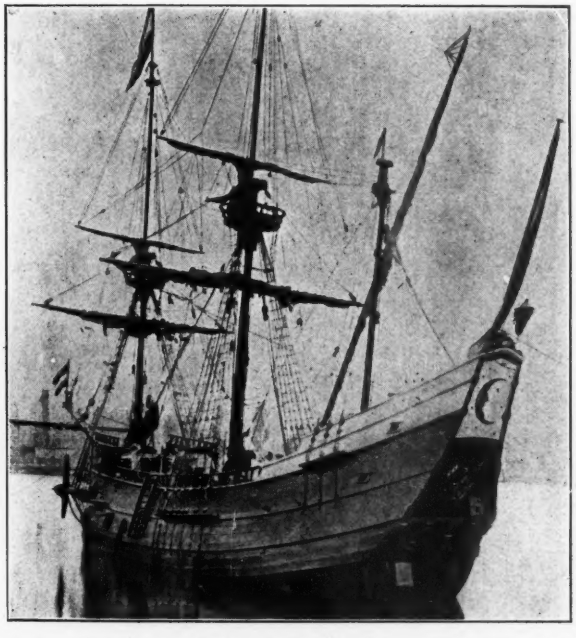
In the meanwhile the replicas of the *Half Moon* and the *Clermont*, accompanied by their more immediate escort, will pass up between the lines of warships to 110th Street and will be greeted by a salute in passing. Arriving at 110th Street, the formal presentation of the two vessels will be made, the exercises taking place on a landing stage constructed at that point.

The parade of the civic fleet will be repeated in the evening, starting at 7:30 P.M., and will make a very brilliant spectacle, for the moving vessels as well as the warships will be illuminated with electric lamps, which will outline their form with a tracery of fire.

On Wednesday, September 29, about 9:30 A.M., the *Half Moon* and the *Clermont* will leave their anchorages at 110th Street and will proceed up the river, stopping for a time at Yonkers, Tarrytown, Ossining, Peekskill and Cornwall. On Friday, October 1, these vessels will arrive at Newburgh, where they will meet the Upper and Lower Hudson fleets. The latter fleet will leave New York on the morning of October 1, and will consist of the submarine *Costine* (the first submarine), twelve torpedo boats and a large number of other ships, divided into six squadrons.

There can be no question that the naval parade with which the Hudson-Fulton Celebration begins, represents the central idea of the whole festival. The spectators, in gazing upon the immense fleet of modern vessels, may find it difficult to realize that the tiny ships, the *Half Moon* and the *Clermont,* so faithfully reproduced for this occasion, occupy a more important place in the world's history than will all the gigantic vessels that are assembled to honor the two remarkable men who accomplished so much with such scant resources.

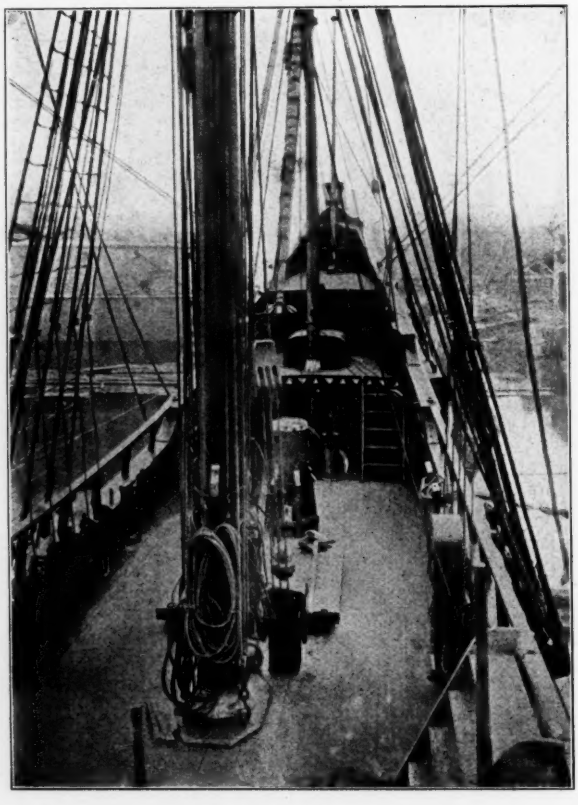
This lesson is especially important in our time, for the tendency of our day is to lay undue stress upon mere magnitude, and to believe that larger ships, larger buildings and larger cities necessarily mark a real progress in civilization. No sane person will deny the fact that the conditions of life have changed and are changing for the better—slowly, it is true—but there can be as little question that the rate of progress would be greatly accelerated if the essentials of civilization



THE HALF MOON.

were more regarded than the development of mere material greatness.

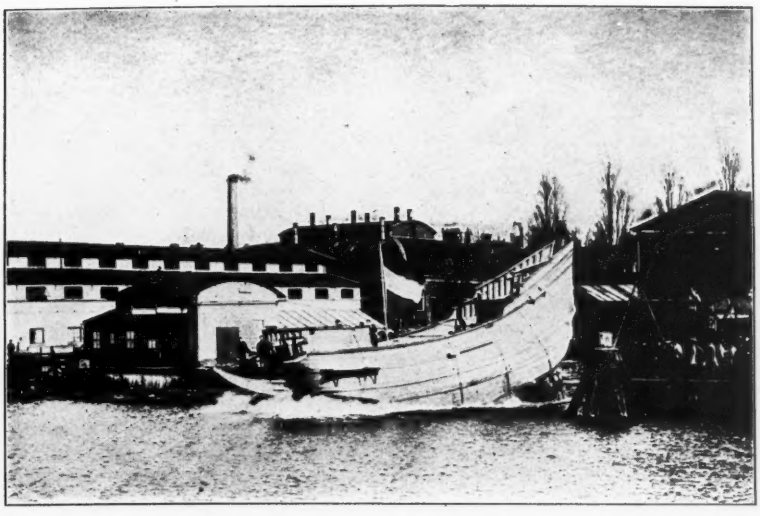
The first of the land parades, the great historical pageant, will take place on Tuesday, September 28, and will consist of 54 cars, or "floats," bearing groups of figures and accessories illustrating scenes from the history of the city or state of New York. These floats will be accompanied by marching bodies from various civic societies, American and foreign. The one which will head the procession has been named "The New York Title Car" and will bear a seated figure of the God-



THE HALF MOON.

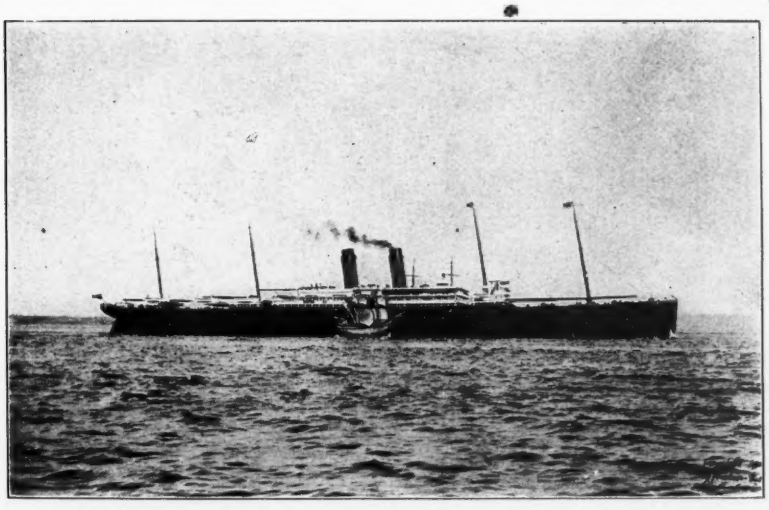
dess of Liberty; two owls, the birds of Minerva, are perched upon the high back of the chair on which the goddess sits, signifying that wisdom has guided her in her progress. The contrast between the primitive conditions of Henry Hudson's time and those of the present day is strikingly presented by the model of an Indian canoe alongside of that of an ocean liner, and by representations, in due proportions, of a "skyscraper" and of an Indian wigwam.

The parade will be divided into four divisions, devoted, respectively, to the Indian, the Dutch, the Colonial and the Revolutionary periods, each division being preceded by a car bearing a group which epitomizes

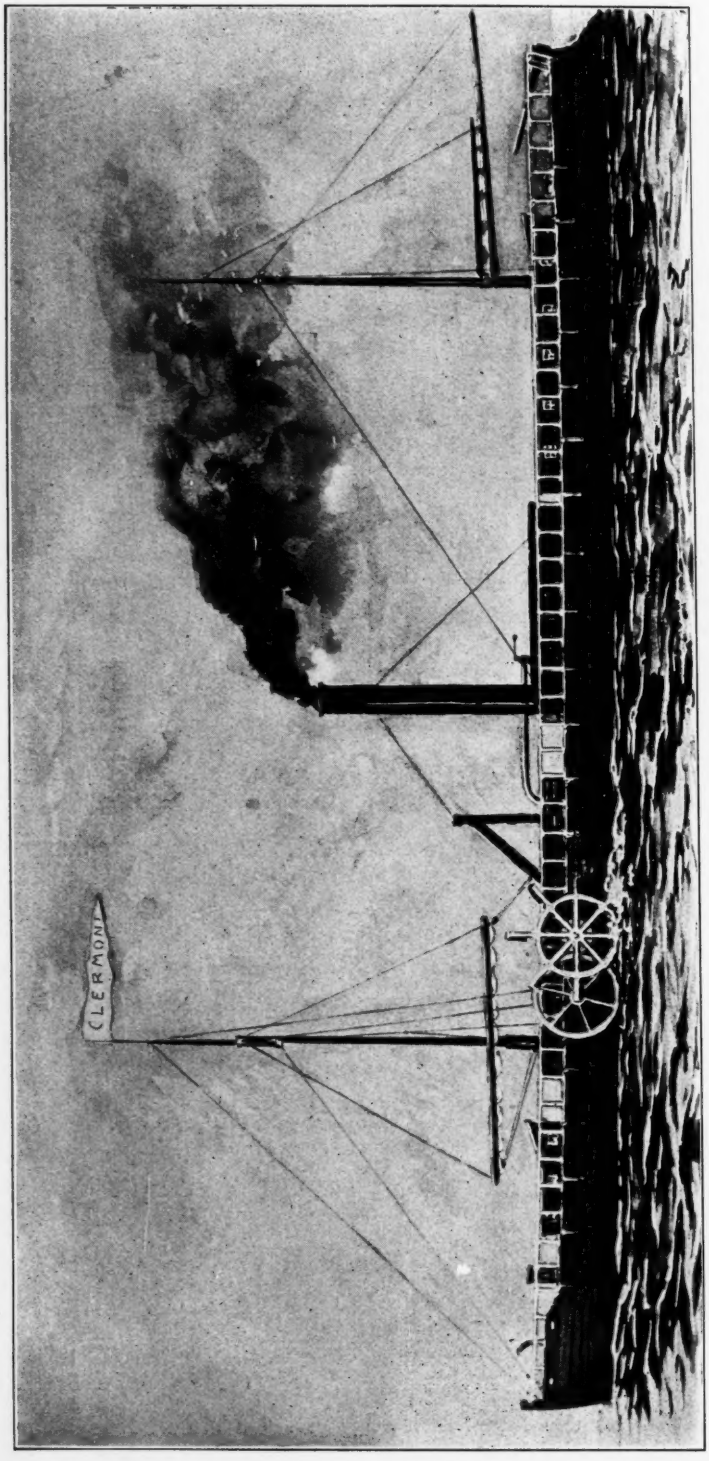


LAUNCHING OF THE HALF MOON AT AMSTERDAM.

the leading characteristics of the period. The last car typifies the hospitality of our city, a gigantic figure of Old Father Knickerbocker standing upon it with hands outstretched and extending a hearty welcome to all the nations of the earth. In order to add to the verisimilitude of the different groups, Iroquois Indians have been secured to man the Indian floats; members of the various Holland societies to represent



COMPARATIVE PICTURE, "CELTIC" AND "HALF MOON." *Celtic* (1909)—length 700 feet, beam 75 feet, depth 49 feet, displacement 37,870 tons, tonnage 20,904 tons, horsepower 13,000. *Half Moon* (1609)—length 74.54 feet, beam 16.94 feet, depth 10.08 feet, tonnage 80 tons. The *Celtic* crosses the Atlantic in a little less than eight days. The *Half Moon* crossed the Atlantic in fifty-nine days.



THE CLERMONT.

Copyrighted, 1909, by Hudson-Fulton Celebration Commission.

the characters on the Dutch floats, and descendants of the old Colonial families, members of the Society of Colonial Wars, Sons of the Revolution, etc., to perform the same service on the Colonial floats. The float showing the capture of Major André will be manned by descendants of John Paulding, one of André's captors.

The parade will begin at 110th Street and Central Park West and will proceed down Central Park West to 59th Street, through that street to Fifth Avenue, and down Fifth Avenue to Washington Square.

This parade will be repeated in Brooklyn on Friday, October 1, proceeding from the Memorial Arch at the entrance to Prospect Park by way of the Eastern Parkway to Buffalo Avenue. Richmond Borough will also have its historical parade, on a smaller scale, it is true. This will take place on Monday, September 27, and will traverse the Amboy Road, between New Dorp and Oakwood. The ceremonies on the site of the first church on Staten Island, founded by the Waldensians, will commemorate the first permanent settlement on the island.

The military parade will take place on Thursday, passing over the route followed by the historical pageant. It will be composed of the Federal Troops of the Department of the East, the National Guard of the State of New York within the limits of New York city, the United States Navy and Marine Corps, the Naval Reserve, the veteran organizations, and marines and sailors from foreign warships. It is estimated that 25,000 men will be in line.

The carnival parade on Saturday evening, October 2, will traverse the route followed by the historical parade and the military parade. This will unquestionably be one of the most interesting and probably the most brilliant feature of the celebration. It will be under the care of the German societies of New York, and the Germans have always displayed a remarkable aptitude for organizing and designing pageants of this kind. The fifty cars composing the parade will be artistically illuminated, and many thousands of torch-bearers will precede and follow the emblematic groups. These will represent music, art and literature, and the wide field of German legend, song and history will furnish most of the themes. The streets along the route of the parade will be made as light as day by festoons of electric lamps. This pageant will be repeated in Brooklyn on the evening of Saturday, October 9, and will pass along the Eastern Parkway.

The general illumination of the city every night during the festival period will offer the most brilliant spectacle ever seen in this country. All the municipal buildings, as well as thousands of private buildings, will be lighted up by tens of thousands of electric lights. The four bridges spanning the East River will be radiant with rows of lights, 14,000 being placed on the Queensboro Bridge, 13,000 on the Brooklyn Bridge, 11,000 on the Williamsburg Bridge and the same number on

the Manhattan Bridge. As seen from any point on the East River, these bridges will be outlined against the dark background of the night, so as as to appear like structures of flame, evoked by a magician's hand. On the other side of the island, both shores of the Hudson River from Forty-second Street to Spuyten Duyvil will be ablaze with light. At 110th Street there will be a battery of twelve searchlights, aggregating 1,700,000 candle power; these lights will be directed up, down and across the river, illuminating an immense radius. Another battery of searchlights, four in number and aggregating 400,000 candle power, will cast its rays upon Grant's Tomb, which will be thrown into striking relief by the dazzling light.

The historical parade and all the other pageants of the week will

arouse in the minds of the beholders a more lively understanding of the history and development of our city, and, while delighting the eye, will convey an important lesson in the very best and most effective way —that is, unconsciously. A population like ours is greatly in need of some powerful stimulation of this kind to weld together all its heterogeneous elements. But let it not be supposed that this is the only end to be attained; such brilliant spectacles are a good in themselves and none will appreciate this more thoroughly than those whose life is merely a sad and monotonous struggle for their daily bread. On this occasion the poorest and the richest will share equally in the enjoyment of the various splendid and artistic spectacles.

Of the special exhibitions which have been organized by the Art and Historical Exhibits Committee, the most important is the magnificent collection of masterpieces by Dutch painters which will be seen in the Metropolitan Museum of Art, at Fifth Avenue and Eighty-second Street. Never before have so many splendid examples of Dutch art been gathered together in the United States; indeed, the exhibition as a whole has never been rivaled even in Europe. Here may be seen no less than thirty-five Rembrandts, a larger number than exist in any permanent collection, except that of the Hermitage in St. Petersburg. Then there are nineteen portraits by Franz Hals, who is only inferior to Rembrandt among the Dutch portraitists, and five specimens of the work of Vermeer van Delft, whose pictures are extremely rare, there being only thirty authentic examples extant. Besides the works of these artists there are fine and characteristic pictures by Jacob and Salomon Ruysdael, Cuyp, Hobbema, Metsu, Van Ostade and many others who were contemporaries of Henry Hudson. These works come from the finest private collections in the United States and many years will pass before an equally favorable opportunity will be afforded for the study of Dutch pictorial art.

The special exhibition also embraces a large and valuable collection of furniture, silver, pewter, porcelain and glass, produced in this country between 1625 and 1815, the year of Fulton's death; and there is also a fine collection of paintings by American artists born before 1800, including pictures by Woolaston, Copley, West, Allston, Peale, Stuart, Trumbull, Fulton, Doughty, etc.

We have all read of the Indians who were settled on Manhattan Island before the arrival of Henry Hudson, but few realize how many relics of these aborigines have been found here, especially at the upper end of the island. A large and valuable collection of these relics may be seen in the American Museum of Natural History, at Central Park West and Seventy-seventh Street, and a classic monograph, written by Dr. Clark Wissler, can be obtained at the same place, and will enable the visitor to understand the significance of the various relics. The

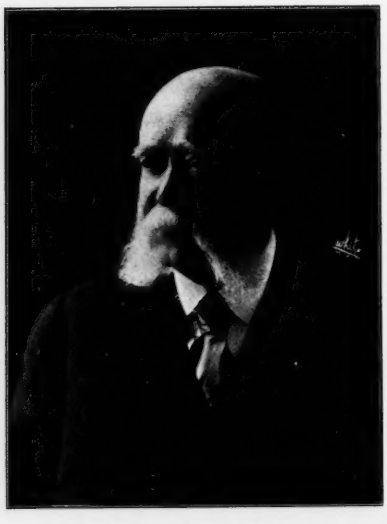
manners and customs of the Indians of Long Island are represented by an important exhibit in the Brooklyn Institute. Independent of any museum, and of ethnological interest, will be the 125 Indians, men, women and children, from New York reservations, who will participate in the landing of the *Half Moon,* and in several of the parades.

The early history of New York and the beginnings of steam navigation will be illustrated by an exhibition of views, paintings, manuscripts, books, etc., shown in the Lenox branch of the New York Public Library, detailed information in regard to the exhibits being offered in a special catalogue. The New York Historical Society, in its new building, on Central Park West, corner of Seventy-seventh Street, just below the American Museum of Natural History, exhibits many interesting pictures and relics relating to Robert Fulton. At the National Arts Club, No. 15 Gramercy Park, the special collection is entitled "Three Hundred Years of New York," and the visitor will see a large number of pictures and other objects illustrating the development of the city and its rapid and marvelous growth. A collection of oil paintings and old manuscripts concerning the early history of New York is exhibited by the Genealogical and Biographical

Society, No. 226 West Fifty-seventh Street, and rare manuscripts and books on the same subject may be seen at the College of the City of New York, St. Nicholas Avenue and 138th Street.

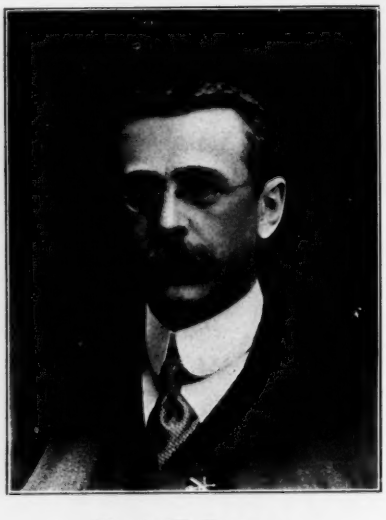
As is the case with all great inventions, steam navigation was not the work of one man alone, although Robert Fulton was the first to apply it consequently and permanently. Epoch-making inventions have usually been the work of a group of men pursuing the same end, often independently of each other, but the credit and glory of success is reserved for that one of them who possesses the energy and persistence requisite for ultimate triumph. Before Fulton built the *Clermont,* John Fitch had constructed a boat operated and propelled by steam, and John Stevens had already sailed a steamboat, his *Phœnix* being undoubtedly the first steamboat to sail on the ocean; but Fulton applied the ideas of Fitch and improved upon them to such an extent that he is rightly regarded as the parent of steam navigation. Aided by the advice of Chancellor Livingston, he secured a sort of monopoly in steamship building and his name will always be remembered among those of the great benefactors of humanity.

The portrait of Fulton by Benjamin West is justly regarded as one



GENERAL STEWART L. WOODFORD,
President of the Hudson-Fulton Celebration Commission.

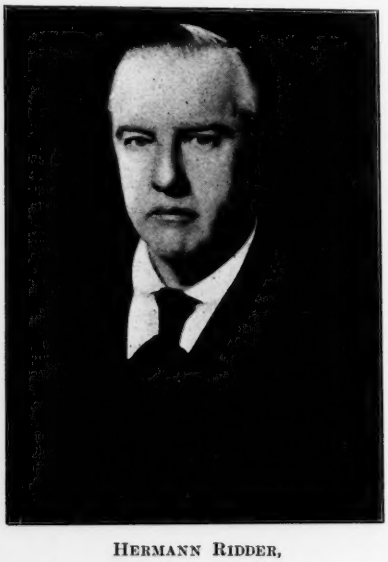
us something not to be found in other portraits, namely, the idea, or perhaps we should rather say the ideal, the artist has formed of himself.



HENRY W. SACKETT,
Secretary of the Hudson-Fulton Celebration Commission.

[2] In Brooklyn Institute exhibit. Published by his permission.

of the best works of our American painter, who became president of the Royal Academy in London. Fulton himself was an artist of considerable ability, and pursued his art studies in London under West's direction. Among his works is a most interesting portrait of himself, which can be seen in the Brooklyn Institute. Although this does not equal West's portrait in artistic merit, like other attempts of artists to portray their own features it gives



HERMANN RIDDER,
Vice-president of the Hudson-Fulton Celebration Commission.

One of the most interesting of the printed documents referring to the Revolution is an old "Broadside" printed in New York, March 25, 1783.[2] We are here given a vivid idea of the time required for the transmission of news in that day, for this sheet tells us that the first news of the signing of the preliminaries to the treaty of peace at Paris

Loaned by Colonel Henry T. Chapman.

on January 20, 1783, reached Philadelphia, by way of Cadiz, Spain, on the twenty-seventh of March.

The flora of Manhattan Island and its vicinity, in the time of Henry Hudson, is shown in the New York Botanical Garden, where these specimens are indicated by the letter " H," and in the parks of Brooklyn and Queens boroughs, a special sign in this case indicating the trees and shrubs which grew here in 1609. It is difficult for those who see this city of stone, brick and concrete to imagine its appearance in Henry Hudson's time, when stretches of meadow land alternated with groves or small forests of trees, over the greater part of the territory, while the upper part of Manhattan Island was traversed with rocky ridges rising in some cases to a considerable height above tide-water. Except in the outlying portions of the city, all these irregularities have been effaced, but the large parks, especially Morningside Park and a portion of Central Park above 100th Street, still show much of the primitive conditions.

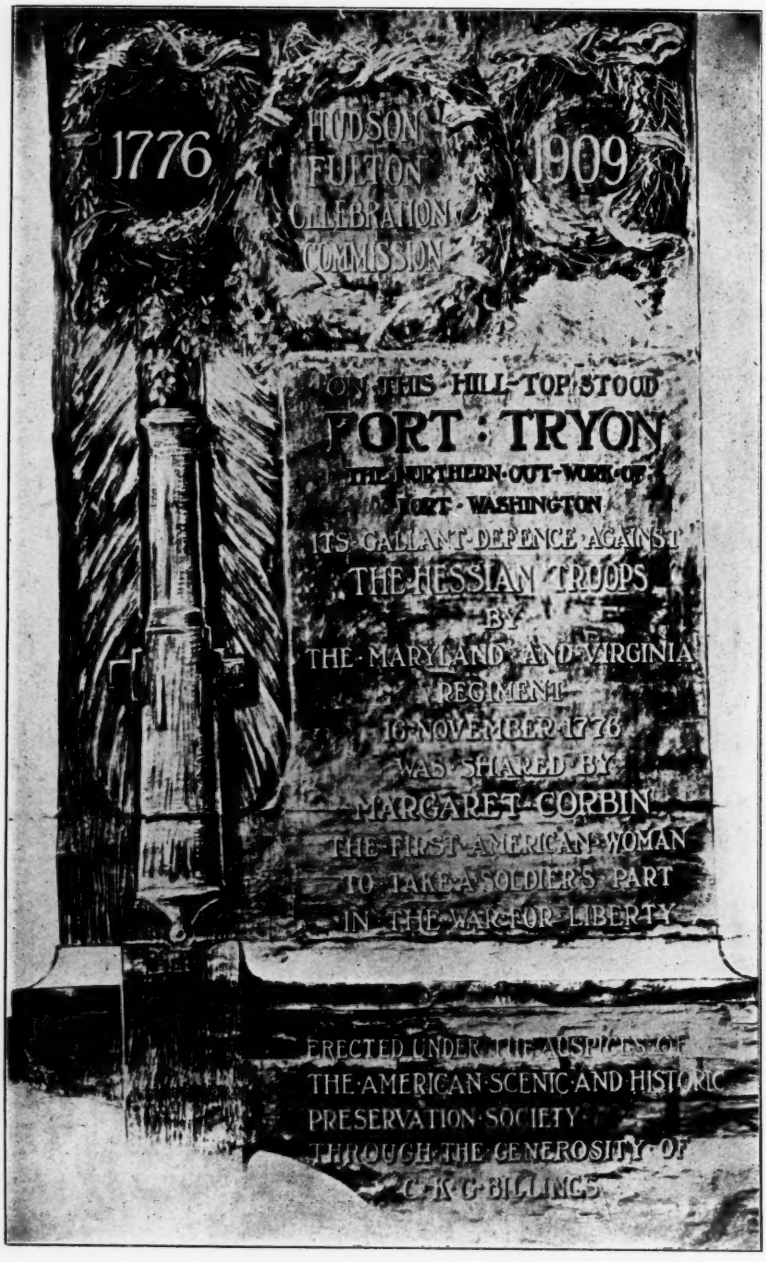
Such a transformation makes the old pictures of Manhattan Island seem unreal, nevertheless it should be a consolation for the present landowners to know that the land was duly and legally acquired by the first Dutch settlers, and although Peter Minuit may have made a good bargain, the title is clear and without stain.

Those who wish to form some idea of the fauna of this region at the time of Hudson's arrival should visit the New York Zoological Garden, where the specimens in question are marked by the flag of the Hudson-Fulton Celebration. In the New York Aquarium appropriate signs have also been placed on the tanks containing fish indigenous to the Hudson River and the waters surrounding New York.

For many special exhibitions catalogues have been prepared at considerable expense. The price at which they are sold scarcely covers the cost of printing them from the plates. A first edition of 5,000 to 10,000 copies has been printed, but when this supply is exhausted new editions of, say, 2,000 copies will be issued from time to time as occasion requires.

One of the leading features of the celebration will be a grand banquet of 2,000 persons in the magnificent new dining-hall of the Hotel Astor. This will be the greatest fine banquet ever given in this country, and the use of the hall has been held back to have this the initial banquet. It is true that in point of size it can not be compared with the dinner given to 22,000 *maires* of the French communes, at the opening of the Paris Exposition in 1889. Some idea of the gigantic proportions of this function may be given by the fact that the plates used in serving the dinner, if placed on top of each other, would have made a pile two miles in height. However, this was merely a dinner, while the function in the Hotel Astor is a grand banquet faultless in every detail.

In Brooklyn the social side of the celebration will find expression in



a ball to be given at the Brooklyn Academy of Music. Invitations have been extended to the officers of the American and International fleets, the diplomatic representatives of foreign nations, and many other distinguished guests, and the ball will undoubtedly be a brilliant and imposing affair.

Lovers of good music will have ample opportunity to gratify their

tastes. On Sunday evening, September 26, the masterpieces of Irish music and song will be rendered in Carnegie Hall by Irish citizens of New York, many of the songs being given in both English and Gaelic. In the Hippodrome, on the same evening, there will be a concert by the United German Singers of the Northeast District of New York.

On Monday evening, September 27, the Hudson-Fulton official ceremonies will open with a reception to the distinguished visiting guests at the Metropolitan Opera House, when all the distinguished foreign guests will present their addresses, after an official welcome by the Hudson-Fulton Celebration Commission, Gen. Stewart L. Woodford, Charles E. Hughes, Governor of the state of New York, Mayor George B. McClellan, and Mrs. Julia Ward Howe, over ninety years old, author of the "Battle Hymn of the Republic," will recite a poem.

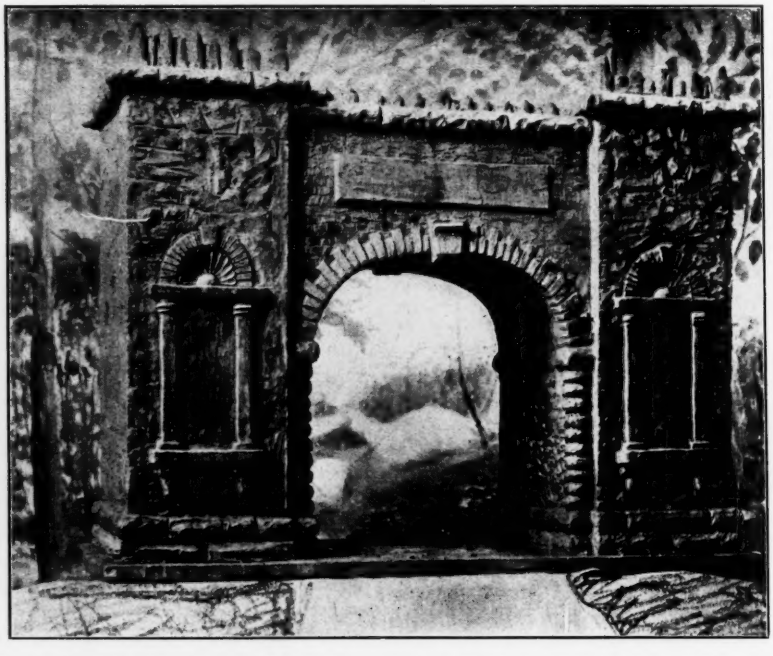
On Tuesday evening, September 28, there will be a musical festival by the German Liederkranz in the Metropolitan Opera House, and on Thursday evening, September 30, a concert will be given by the New York Festival Chorus in Carnegie Hall. Lastly, there will be a sacred concert at Carnegie Hall by the People's Choral Union, under the leadership of Walter Damrosch, on Sunday, the third of October.

Educational exercises, dealing with subjects appropriate to the celebration, and designed to be participated in by universities, colleges, schools, museums and learned and patriotic societies throughout the state, will be held on Wednesday, September 29. In New York City, the following lectures will be delivered in various rooms of the New York University: "Literature of the First Two Centuries of New York City," by Professor Francis H. Stoddard; "Conditions Determining the Greatness of New York City as a Commercial and Financial Center," by Professor Joseph F. Johnson; "The Political History of New Netherland," by Professor Marshall S. Brown; "History of Education in New York," by Professor Herman H. Horne; "Fulton and Other Promoters of Steam Navigation," by Professor Daniel W. Hering; "History of Steam Navigation," by Professor Charles E. Houghton; "A Comparison of the Steam Engine Before 1809 with Fulton's Steam Engine," by Professor Collins P. Bliss; "The Physiographic Development of the Hudson River Valley," by Professor Joseph E. Woodman. There will also be exercises in connection with the university's schools in Washington Square. In Brooklyn Borough there will be literary exercises on Tuesday evening, September 28, at the Brooklyn Academy of Music.

Commemorative services will take place throughout the city and state on Saturday, September 28. On this day the Reformed Protestant Dutch Church of the City of New York, organized in 1628 and representing the earliest religious organization in New York, will hold special commemorative services at 11 A.M. and 8 P.M., in its churches at Second

Avenue and Seventh Street, Fifth Avenue and Twenty-ninth Street, Fifth Avenue and Forty-eighth Street and West End Avenue and Seventy-seventh Street.

The Henry Hudson Monument on Spuyten Duyvil Hill will be dedicated on Monday, September 27, and is so placed as to form a prominent landmark. From a base ornamented with bas-reliefs springs a fluted Doric column, surmounted by a pedestal supporting the statue of Hudson. This monument, by Karl Bitter and Schrady, is a chaste and beautiful work of art. It is 110 feet high, and, being set upon an



GATEWAY ERECTED ON STONY POINT BATTLEFIELD BY DAUGHTERS OF THE REVOLUTION (New York State) and to be dedicated during Hudson-Fulton Celebration—September 25 to October 9, 1909—as part of the official program. Hudson-Fulton Celebration Commission.

elevation 200 feet above tide-water, it can be seen from a distance of several miles up and down the Hudson River, and even from the waters of Long Island Sound; the sum required for its erection was supplied by private subscription. The monument rests on the site of the Indian village of Nipinichsen, whence, on October 2, 1609, an attack was made upon the *Half Moon*.

The last scene of Hudson's life makes a gloomy picture. Set adrift in a small boat by the mutinous crew of his ship *Adriatic*, he passed away out of the sight of men and was never heard of again. In the dreary hours of aimless drifting over the tossing waves, and face to face with death, Hudson had not even the consolation of knowing that his

name would be handed down to posterity, and that nearly three centuries after his death millions of his race and speech would assemble to do him honor.

Land is so valuable on Manhattan Island that but few remain of the old buildings associated with the early history of the city. For this very reason a visit to four of these historic buildings which have been preserved from destruction will be of interest. Fraunces' Tavern, situated near the corner of Pearl and Broad Streets, is famous as the place where Washington bade farewell to his officers, December 4, 1783. The collection of old pictures and historic relics gathered here will gain in interest by the associations connected with the place.

Another building dating from colonial times is that formerly known as the Morris Mansion, or the Jumel Mansion. This fine old residence was built about 1760 and it was here that Washington established his headquarters during the military operations on the upper part of Manhattan Island. The building is now the property of the City of New York, and is under the care of the Daughters of the American Revolution (State of New York), who have brought together a very interesting collection of mementoes of the Revolution.

The Van Cortlandt Mansion, erected about 1748, is a fine and characteristic specimen of the colonial style of architecture, and will contain a valuable collection of portraits of men who played a leading part in the Revolution. This building is cared for by the Colonial Dames of the State of New York.

The Aquarium building in Battery Park was originally erected, in 1807, as a fort, and was named Fort Clinton in 1812. Many years later it was transformed into a theater and concert hall, under the name of Castle Garden. There are some still living who can recall the wild enthusiasm evoked by the "Swedish nightingale," Jenny Lind, when she made her first appearance before an American audience in this building. In 1855 a new use was found for Castle Garden and it became the goal of an immense host of immigrants, 7,690,606 passing through its portals in the period from 1855 to 1890.

One of the interesting exercises connected with the celebration will be the dedication of the Memorial Arch erected by the Daughters of the American Revolution in the Stony Point Battlefield State Reservation. The ceremonies will take place on Saturday, October 2. The governor of the state and many prominent citizens, as well as a number of military and civic organizations, will be present. The National Scenic Preservation Society, the official custodian of the reservation, will cooperate in the formal exercises.

On Wednesday, September 29, at 4 P.M., the American Scenic and Historic Preservation Society will dedicate the tablet erected through the generosity of Mr. Cornelius K. G. Billings, on the site of Fort Tryon,

on Fort Washington Avenue. This fort was gallantly defended on November 16, 1776, by the Maryland and Virginia Regiment, against the attack of the Hessian troops.

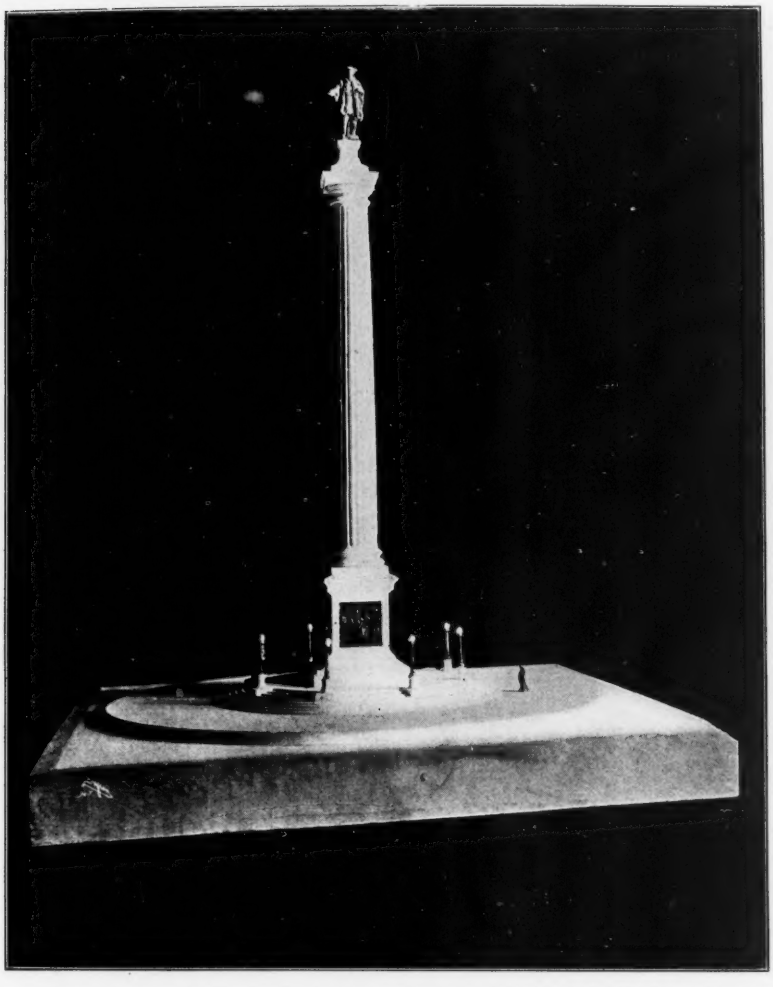
The following dedications have also been officially recognized by the commission: On Wednesday, September 29, the City Wall Bastion Tablet, at No. 48 Wall Street, New York, marking the site of a bastion in the old city wall to be dedicated by the Society of Colonial Wars in the State of New York; the Fort Amsterdam Tablet placed on the United States Custom House in New York City, marking the site of Fort Amsterdam, dedicated by the New York Society of the Founders and Patriots of America. On Monday, September 27, the Palisades Interstate Park, extending for thirty miles along the western shore of the Hudson River, from Fort Lee, N. Y., to Piermont, N. Y., will be dedicated by the commissioners of the Interstate Palisades Park. The date for the dedication of the bust of Verrazzano, the Italian navigator who visited New York Harbor in 1524, has not yet been selected by the Italian societies which have donated it to the city.

Aquatic sports will be the order of the day on Wednesday, September 29, when boat races will be held on the Hudson River, the boats being manned from the crews of the foreign and American warships. There will also be interstate contests between members of the Naval Reserves from different states, canoe races and motor-boat races. At Yonkers, on the same day, high-power motor-boats will compete, and there will be boat races between various amateur crews from clubs.

The astonishing progress in aeronautics during the past year has excited public interest to the highest pitch, and the celebration commission is making every effort to assure the presence of some of the leading aeronauts and aviators. While the arrangements for this branch of the celebration are not fully completed at the time of writing, the public will certainly be given an opportunity to see many types of dirigibles and aeroplanes, and some sensational flights will be made. If the weather conditions are favorable, the aeronautical exhibitions will begin on Monday, September 27.

In organizing the various parades and exercises, the celebration commission has not forgotten the children of our city, for whom special festivals will be held, on Saturday, October 2, at fifty different centers. There will be games, historical plays, folk-dances, etc., given by thousands of children from the public schools, and accommodations will be provided for a half million children to witness the spectacles.

The close of the celebration in all its phases will be marked by a chain of immense beacon-fires lighted on mountain tops and heights from Staten Island to the head of navigation on Saturday evening, October 9. All these beacons will be connected by electric wires and will be lighted simultaneously by President Taft. The beacons are made of peat with chemicals, so that they will burn even if it rains.



HENRY HUDSON MONUMENT. To be erected on Spuyten Duyvil by popular subscription at a cost of $100,000, and to be dedicated as a part of the official program of the Hudson-Fulton Celebration. This monument is by Karl Bitter and Schrady, is 110 feet high and will stand on an elevation of two hundred feet above the water, being visible for many miles above the Hudson River and from Long Island Sound.

A special two-cent stamp to commemorate the Hudson-Fulton Celebration has been issued by the Post Office Department. The background of the design shows the Palisades, with the *Half Moon* sailing up the Hudson River, and the *Clermont* steaming in the opposite direction; in the foreground is an Indian in a canoe, and another canoe manned by four Indians can just be discerned in the distance. The commission has to thank Congressman Bennett and his colleagues, Congressmen Parsons and Olcott, for their successful efforts in securing the consent of the Postmaster General to the issue of these stamps, of which fifty million will be printed.

THE ORIGIN OF THE NERVOUS SYSTEM AND ITS APPROPRIATION OF EFFECTORS

By G. H. PARKER

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IV. The Appropriation of Effectors

IN the preceding articles in this series the origin and development of the neuromuscular mechanism has been broadly sketched in a succession of representative stages. The first stage was that of the independent effector, the muscle which was brought into action by the direct influence of environmental changes as seen in the pore sphincters of sponges. The second stage was that of the combined receptor and effector in which the receptors, in the form of diffuse sensory epithelia or specialized sense-organs, served as delicate triggers to set the muscles in action and thereby render the effectors responsive to a wider range of stimuli than they would be under independent stimulation. Finally, the third stage is seen in the complete neuromuscular mechanism in which a central nervous organ or adjustor has developed between the receptors and the effectors. This adjustor serves as a switchboard for nervous transmission and a repository for the effects of nervous activities.

This line of progressive differentiation from the muscle to the complete nervous system is complicated by the fact that in the more complete examples of the third stage the nervous system is found connected not only with such effectors as muscles, but with electric organs, chromatophores, glands, luminous organs, etc. If the history of the growth of the neuromuscular mechanism as it has been sketched in these articles is a correct one, the effectors just named must be regarded in the light of relatively recent acquisitions and in my opinion they illustrate an invasion and appropriation on the part of the nervous system of territory that was not originally under its control. This principle of appropriation results not only in the acquisition of totally new forms of effectors such as glands, etc., but also in gaining control over independently and newly developed muscles. Examples of this kind will be taken up first in discussing this question of nervous appropriation.

The differentiation of the central nervous organs is in large part a process that goes on hand in hand with the differentiation of the muscles. This is well seen not only in the higher invertebrates, but also in the vertebrates. The differentiation of a single muscle into a group of muscles and the consequent and corresponding changes in the nerv-

ous relations, both central and peripheral, are too well known to require comment. To this process must be added, I believe, the appropriation of totally new muscles. There is good reason to assume that the heart-beat in tunicates is of myogenic origin and the fact that the embryonic vertebrate heart pulses before it contains any nervous elements is strong evidence in favor of the view that the cardiac muscle of the primitive vertebrate was a muscle developed independently of nervous control. That that muscle in modern adult vertebrates is under a certain amount of nervous control is unquestionable, but this control is not of the kind usually seen in other neuromuscular combinations. The nerves that enter the heart are probably not ordinarily directly concerned with its beat, for, as already pointed out, this continues after they are cut. The function of these nerves seems to be that of modifying this beat and in this respect two classes of fibers may be distinguished: augmentors which increase the beat, and inhibitors which retard or even check it. This whole nervous mechanism has the appearance of having been superimposed upon a muscle that was originally non-nervously active, and I therefore regard the vertebrate heart as an example of an originally independent muscle secondarily brought under the influence of central nervous organs. Many other muscles, like the sphincter pupillæ, etc., have doubtless had a like history, but as they have not been investigated from this standpoint, the question of their exact relations to nervous control must remain for the present somewhat open.

In the vertebrates at least, nervous effectors include not only muscles, but also electric organs. These organs occur not infrequently among the fishes. They are best represented in the South American electric eel, the electric catfish of Africa and the torpedoes of the Mediterranean Sea and the Atlantic and Indian Oceans. They also occur less fully developed in certain skates, mormyres and the star-gazer. These organs are usually imbedded in a mass of the fish's muscle or they occupy such positions that they clearly replace muscles. Their histogenesis, as worked out particularly in the skates by Ewart (1888), shows conclusively that each electric plate is a modified muscle-fiber and in fact there seems to be good reason to conclude that all known electric organs, excepting possibly those of the electric catfish, are modified muscles. This is entirely consistent with what is known of the physiology of these two kinds of effectors, for muscles not only move parts, but generate through their activity a certain amount of electricity, while the electric organs have lost the power of producing molar movements and have enormously increased that of producing electricity. Electric organs, though often described as a special class of effectors, are in reality merely modified muscles and therefore can not be regarded properly as a new appropriation of the nervous system.

The chromatophores, on the other hand, are effectors which are in no sense derived from muscles. These organs enable many animals to make relatively sudden changes in their external coloration, and though they are present in many animals, they are most perfectly developed in the arthropods, mollusks and vertebrates. They are also present in the more complex types of eyes, where their movements serve to protect the receptive elements from exposure to excessive light or to open them to the full effects of dim light. The investigation of these organs dates from comparatively recent times and van Rynberk (1906), who has recently summarized our information about them, has shown that the accounts already given are in many respects contradictory. Hence what I shall have to say I shall draw mostly from those fields with which I am somewhat acquainted at first hand.

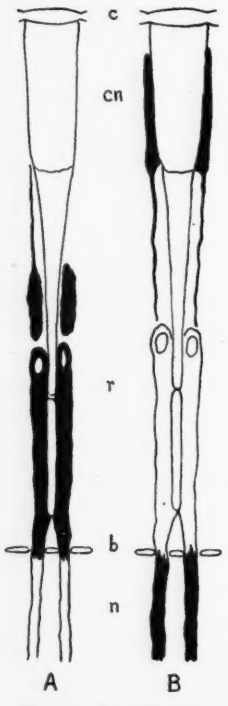

FIG. 1. TWO ELEMENTS FROM THE COMPOUND EYE OF A SHRIMP, showing the distribution of pigment in the light (*A*) and in the dark (*B*). *b*, basement membrane; *c*, cuticula; *cn*, cone; *n*, nerve-fiber; *r*, retinular cell.

That some chromatophores are completely independent of nervous control even though they are most intimately associated with nervous mechanisms is well attested. The deeper part of the compound eye in the shrimp, *Palæmonetes,* contains a layer of cells, the retinular cells (Fig. 1), which though they carry rhabdomes and end proximally in nerve-fibers and are therefore unquestionably sensory cells, contain many dark pigment-granules which change positions in accordance with the illumination. From this standpoint these cells are true chromatophores. In an eye exposed to the light the pigment-granules occupy distal positions in these cells; in one in the dark they come to lie in proximal positions. The place occupied by the pigment in a given eye is entirely determined by the presence or absence of light in that eye, for the two eyes have no sympathetic relations. Moreover if a persistent shadow is cast on part of one eye, the condition characteristic for the dark is assumed by that part even though the pigment in the rest of the eye is in the position characteristic for light. These observations show the physiological independence of the chromatophores in different parts of the eye. These organs, though connected by nerve-fibers with the central nervous organs, are also in their action independent of such parts, for the movements of their pigment from the dark to the light position and the reverse go on in an essentially normal way even after these connections have been cut. Chromatophores then may carry out under direct stimulation somewhat complicated pigment-migrations in

intimate relations to the successful action of such an organ as an eye, and yet with complete independence of central-nervous control.

Other chromatophores, like those in the skin of lizards, can be as clearly demonstrated to be under the control of nerves as those in the eyes of *Palæmonetes* have been shown to be free from this control. The integumentary color changes in lizards are often extremely complicated processes, especially in such forms as the chameleon, but they include as a fundamental principle the inward and outward migration of dark pigment-granules within certain large unicellular chromatophores (Fig. 2). When these pigment-granules pass out into the processes of the chromatophores, they give to the surface of the lizard a dark or even black aspect. When they migrate inward to the body of the chro-

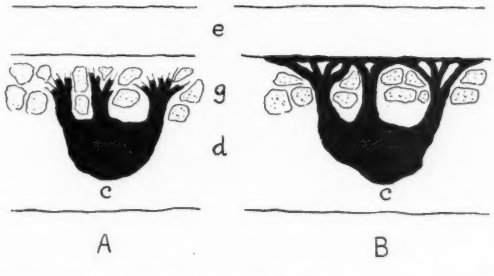

FIG. 2. TWO CHROMATOPHORES FROM THE SKIN OF A LIZARD, showing the condition due to the dark (*A*) and to the light (*B*). *c*, chromatophore; *d*, derma; *e*, epidermis; *g*, irregular masses of ground color.

matophore, which is often hidden in pigment masses of some particular color, they thus allow the ground-color behind them to assert itself. By this simple inward and outward migration of the pigment, the chief change in the color differences of the lizard's skin is accomplished. The question that we have to consider is to what extent these changes are controlled by the central nervous organs.

The inward and outward migration of the pigment of the chromatophores is well seen in the skin of the so-called Florida chameleon, *Anolis*. According to Carlton (1903), who has studied this animal with care, the passive state in its chromatophores is that in which their pigment is gathered together in the cell-bodies. This state is brought about when the lizard is removed from the stimulating effect of light, when the blood and nerve supply of a given region are cut off, when the animal is etherized, or when it dies. In fact any change that might be expected to interfere with nervous activity calls forth this condition. Since nicotine is a poison for the sympathetic nervous system, rendering it temporarily inactive, and since the inward migration of the chromatophoral pigment is immediately produced on injecting a very small amount of nicotine into the *Anolis*, it is probable that the reverse process, the outward migration, is dependent upon the normal action of

these poisoned parts, the sympathetic nerves. For these reasons I believe that in *Anolis* the inward migration is a process which is ordinarily under the control of the chromatophore itself and that the outward migration, which takes place all over the animal when even only a small spot in the skin is illuminated (Parker and Starratt, 1905), is dependent upon the action of sympathetic nerves.

In the true *Chameleon,* as Brücke (1852) and many others have demonstrated, precisely the reverse is true; the outward migration is independent of nerves and the inward migration is produced by them. Moreover, judging from the results of experiments on the spinal cord, the nerves which in *Chameleon* are concerned with these changes are not sympathetic nerves, but spinal nerves.

These differences between *Anolis* and *Chameleon* I believe to be well founded. In my opinion both animals have descended from a stock in which the chromatophores were entirely independent of nervous control and in the process of descent the chromatophores of different lines became separately appropriated as effectors of the nervous system. In the ancestors of *Anolis* the sympathetic nervous system became related to the outward migration of pigment; and in those of the *Chameleon* the spinal system associated itself with the inward migration. The fact that *Chameleon* and *Anolis* belong not only to separate families, but to separate suborders of lizards, rather emphasizes this view than otherwise.

Such instances as the independent retinal chromatophores of *Palæmonetes* and the nervously dependent chromatophores of *Chameleon* and *Anolis* lead me to believe that chromatophores are effectors evolved independently of nervous control, but in some cases secondarily appropriated as nervous end-organs.

What has been said of chromatophores so far as their relation to nerves is concerned is probably also true of glands. The majority of glands are unquestionably independent of direct nervous control. In almost all instances a blood supply is essential to the action of a gland, and as this can be controlled by nerves there is thus an indirect influence of the nervous system on the action of the gland, but this nervous control over the blood supply is very different from a direct nervous control over secretion. I know of no good reason to assume that nerves have any direct influence on the secretions of the kidneys, the liver or even the pancreas. The pancreatic juice which appears with such precision on the arrival of food in the small intestine has been shown by Bayliss and Starling (1904) to be secreted not through the action of nerves on the gland, but through the action of a substance, secretin, produced by the food in the intestine and carried by the blood to the gland. If into the blood of a fasting animal whose nerves to the pancreas have been cut a small amount of secretin is injected, the pancreas will begin to produce its characteristic secretion.

Although most glands are not under direct nervous control, some are as completely under this control as the majority of muscles are. The best examples of this condition are the sweat glands and the salivary glands. The fact that when the nerves supplied to the salivary gland are stimulated, secretion may take place at a pressure higher than that of the blood supplied to the gland shows conclusively that the production of saliva is not a simple organic filtration process, but is dependent upon action called forth in the secretory cells by a nervous impulse. This view gains additional support from the fact that in the salivary glands nerve fibers have been found to end in connection with the secretory cells. There is therefore every reason to believe that the salivary glands, and the same may be said of the sweat glands, are organs whose secretions are directly controlled by nerves.

As these several examples show, some glands are completely under the control of nerves and others are not. In my opinion the latter represent the primitive state of this form of effector and the former the condition after such organs have been appropriated by the developing nervous system.

Luminous or phosphorescent organs afford another class of effectors which have probably originated independently and fallen secondarily under the influence of the nervous system. These organs, however, have been studied so imperfectly that it is at present difficult if not impossible to get satisfactory evidence as to their exact condition. Some animals have been supposed to possess phosphorescent organs when in reality their luminosity was due entirely to reflection; others like certain earthworms were found to be phosphorescent because their slime contained photogenic bacteria. But aside from these spurious cases there is an abundant range of truly phosphorescent animals, examples of which occur from protozoans to vertebrates. One peculiarity in their distribution is that true phosphorescent animals are not found in fresh water; they are either marine or air-inhabiting.

In all cases where animal phosphorescence has been examined with care, it seems to be dependent upon the production of a special substance by the light-producing cells. This substance is not in the nature of a living, structurally organized material like muscle, for it can be crushed into a paste and still show light. Moreover, Bongardt (1903) dried the phosphorescent organ of a common firefly over calcium chloride and then kept it in a sealed tube from July 16, 1901, till August 3, 1902, a period of over a year. After this the tube was opened and the organ wet with distilled water; in twelve minutes it glowed so that it could be seen at a distance of two meters. Evidence of this kind supports the view that the phosphorescent substance is not living but rather formed material, such as a secretion, and resembles in this respect pepsin or trysin.

If phosphorescent organs produce a substance essentially a secretion to which their characteristic activity is due, they might without impropriety be classed as glands, but if they are thus classed, it must be remembered that the majority of them are so placed that they have no access to cavities or the exterior; hence they would be in the nature of ductless glands. In one respect, however, they differ even from ductless glands; the substance that they produce is not carried away from them even by the blood-stream but is used locally for the production of light. Hence though phosphorescent organs may be in many important respects like glands, they differ in certain ways from all ordinary glands.

Whether phosphorescent organs are under the control of nerves or not is a question of some uncertainty. The fact that many highly specialized phosphorescent organs have a rich innervation indicates that they are under nervous influence, but even this may be of the indirect kind such as has already been indicated for glands and not a direct control. In ctenophores Peters (1905) has shown that a few paddle-plates will glow on mechanical stimulation precisely as the rows of plates in the normal animals do. He has also shown that the primitive nervous system of these animals plays no direct part in this phosphorescence. This instance seems to me to be a perfectly clear case of phosphorescence not under the control of nerves, though in an animal with a nervous mechanism.

In the common firefly the relations are not so well understood. Thus Bongardt (1903), though he describes an intimate nervous plexus in the luminous organ of this animal, believes that its rhythmic photogenic activity is not under even indirect nervous control. He maintains, on what, however, is not really strong experimental evidence, that the firefly can not extinguish its light through nervous action and he believes that the phosphorescent rhythm is due to totally different factors. This case merely shows the fragmentary nature of our knowledge of this phenomenon even in so well-known an example as the firefly.

As a good instance of nervous control over phosphorescence the brittlestar, *Ophiopsila,* recently studied by Mangold (1907), may be quoted. On mechanical stimulation the ventral surfaces of the arms of this animal glow for a short time. The phosphorescence begins in the stimulated part and, if this be an arm, it may spread over this arm to the disk and thence to the other arms. The course that it follows is that of the radial and circular nerve-strands. If any of these are interrupted by being cut, the phosphorescence does not pass beyond the cut, thus showing that it is probably controlled by the nerve.

These instances, few and confessedly fragmentary as they are, indicate that phosphorescent organs, though in many important respects like glands, are in reality a separate class of effectors and that in some

instances their action is independent of nervous control, while in others it is under this control. In my opinion the instances of independent action represent a primitive state; the others a condition brought about through the appropriation of these organs as end-organs by a developing nervous system.

If what has been stated in this article is correct, we must picture to ourselves as steps in the evolution of the nervous system not only the independent origin of muscle around which the nervous organs subsequently develop, but also the independent origin of other effectors such as chromatophores, glands and phosphorescent organs and the secondary appropriation of many of these by a developing nervous system. This principle of appropriation I believe to be as significant in elucidating the present condition of the nervous system and its appendages, as the principle of evolutionary sequence of parts, muscle, sense organ, and central nervous organ, as given in the first three articles.

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THE SERVICE OF ZOOLOGY TO INTELLECTUAL PROGRESS[1]

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UNDOUBTEDLY the progress of zoology has played an important part in the intellectual development of civilized mankind, but the way in which it has moulded thought is but vaguely appreciated by most people. On that account it is my purpose to discuss the question of the service of zoology to intellectual progress.

We speak of the intellectual development of civilized mankind, meaning thereby the general level of mental development that any people has attained; and we observe that the circumstance that chiefly sets one people on a pinnacle higher than another people is their degree of intellectual development.

There is nothing that affects us all more closely than that our young people should learn to think straight, and that they should ally themselves with the thought of their time, and take part in it, because this mental life of ours is remaking for us our ideas of the universe in which we live. It is not peopling it with phantasies and dreams so much as with realities. There was never a time before when realities were so carefully sought after.

If we look into history we shall see that there has been a ruling power in the mental life of different peoples characteristic of every age, such as the mental devotion of the Romans to law and government, of the Greeks to art and philosophical disquisitions, of the people of the middle ages to mystical metaphysics and theological dogma, and so on.

Let us now ask: "What is the dominant note in intellectual life to-day?" Is it not a greater care to determine the truth? Is it not the investigating spirit? Is it not that spirit which we may designate generically as the scientific spirit? Perhaps great material prosperity is the most evident aspect of life to-day, but in the mental sphere there is certainly a disposition to analyze, to experiment and to arrive at conclusions by the method of observation and reasoning.

This situation is very different from the one from which the civilized world has recently emerged. A former state prevailed in which authority was declared to be the source of knowledge. In the sixteenth century, and earlier, men believed things not because they could be shown to be true, but because some one had said they were true. In order to crush out dissent the authority for a certain statement was quoted, and the authority cited was usually one of the ancient writers.

[1] The annual address before the Iowa State Academy of Science, April 30, 1909.

The Revival of Learning.—But the human mind, ever restive to discover the relation between causes and effects in the production of natural phenomena, would not permanently brook this restraint. The minds of the more energetic and independent thinkers revolted against the reign of authority, and, under the leadership of such minds, there began a reform that is known to us all under the title of the revival of learning, a reform of wide extent and of great importance to the human race. I wish to take a few minutes to point out that the essence of this reform consisted in a change in the method of the pursuit of knowledge.

This so-called revival of learning affords a striking illustration of how a change in mental interests may have great consequences for those who engage in it. Let us first picture to ourselves the fruits of the mental life of the middle ages, and then contrast this with the results of the changed method of ascertaining truth introduced at the time of the revival of learning.

It is an old, oft-repeated story, how with the overthrow of ancient civilization the torch of learning was nearly extinguished. Not only was there a complete political revolution; there was also a complete change in the mental interests of mankind. The situation was complex, and it is true that there were many influences at work, but the extinction of all scientific activity which occurred at this time was due to a complete arrest of inquiry into the phenomena of nature. The physicist no longer experimented, the naturalist no longer sought for relation and causes in living beings.

One circumstance that played a considerable part in the cessation of scientific investigation at this time was the rise of the christian church and the dominance of the priesthood in intellectual as well as in spiritual life. The world-shunning spirit, so scrupulously cultivated by the early christians, promoted a spirit that was hostile to observation. The behest to shun the world was acted upon too literally. The eyes were closed to nature and the mind was directed towards spiritual matters, which truly seemed of higher importance. Presently the observation of nature came to be looked upon as proceeding from a prying and impious curiosity—as an attempt to search out the concealments of the Almighty.

Books were scarce, schools of philosophy were reduced, and any general dissemination of learning ceased. The priests who had access to the books assumed the direction of intellectual life. But they were largely employed with the analysis of the supernatural, and without the wholesome checks of observation and experiment, mystical explanations were invented for natural phenomena, while metaphysical speculation became the dominant form of mental activity.

Authority declared the Source of Knowledge.—In this atmosphere free inquiry could not live, controversies over trivial points were en-

gendered and the ancient writings were quoted as sustaining one side or the other. All this led to referring questions as to their truth or error to authority as the source of knowledge, and resulted in a complete eclipse of the reason.

This was a barren period, not only for science, but also, curiously enough, for those studies which were especially engaged in. Notwithstanding the fact that for more than a thousand years all the new works were written by theologians, there was no substantial advance in their field of learning, and the reflection comes to us that the reciprocal action of free inquiry is an essential condition for the growth of any department of learning.

We should remember that the mental life of the Middle Ages was active. It is a mistake to suppose that men of those times differed much in their mental powers from those of to-day. The medieval philosophers were masters of the metaphysical method of argument, and their ingenuity and mental alertness were great. The principal thing that held progress in check was the method of setting about to ascertain truth.

Renewal of Observation.—It was an epoch of great importance, therefore, when men began again to observe, and to attempt, even in an unskilful way, hampered by intellectual inheritance and habit, to unravel the mysteries of nature and to trace the relation between causes and effects in the universe. The new movement was, as previously said, a revolt of the intellect against existing conditions. In this movement were embraced all the benefits that have resulted from the development of modern science. The invention of printing, the voyages of mariners, the growth of universities, all helped in a general way, but just as the pause in science a thousand years or more earlier had been owing to the turning away from nature and to new mental interests, so the revival was a return to nature and to the method of science.

The Widening Horizon.—The reign of authority in intellectual matters lasted for twelve centuries, and then gave way gradually to the reign of observation and reason. Under the influence of the new method we have been moving generation by generation into a state of clearer discernment and into an intellectual atmosphere of wider horizon.

There is an inspiration in this ever-widening horizon. We must recognize, I think, that there has been a reconstructive force accompanying scientific progress. Wherever traditional opinion has been uprooted something more helpful to humanity has been planted. When rightly understood, we see that this freer life of thought has been constructive and helpful, not merely iconoclastic. Man has once again taken his high place in the world as the interpreter of nature, and as investigation widens his comprehension of the laws of natural phe-

nomena, he is extending his control in the sphere of nature and turning natural forces to his advantage.

The Study of Nature.—I now turn to another phase of the subject, viz.: to a consideration of the effect upon mental life of advances in the knowledge of natural phenomena. Let us, if possible, catch a glimpse of the edifice that has been built upon the foundation since the early naturalists broke ground and began operations.

One of the most notable things of the last half century has been the mental evolution produced by the great extension of knowledge of organic nature. This more intimate acquaintance with natural phenomena, and of living nature in particular, has altered our way of looking at the world, and especially of our relation to it. The whole fabric of thinking has been so profoundly changed by the biological advances to which I refer that all educated people ought to make themselves acquainted with the generalizations of biology and with the foundations upon which they rest. This science is not a remote branch of learning; it touches every-day life at many points, and affects our well-being more closely than is generally realized.

The study of nature and the explanation of natural phenomena possess an inherent interest to which most minds respond. The physicist and chemist have for their territory the field of inorganic nature, but the biologist has the advantage of dealing with the living world. There is, in reality, nothing in the sphere of knowledge more fascinating than the study of life. Any reference to the part that bacteria play in the world awakens a responsive interest. References to the doctrine of evolution, and the light it throws on the origin of the human body as well as on the races of animals, arouse attention. The teachings of science in reference to the life of the globe have awakened wonder, sometimes dissent, but always interest.

Zoology the Central Subject.—Now the kind of knowledge to which I am referring belongs to the domain of biology, and in that domain zoology is the central subject. Many people think of zoology as it was in the time of Linnæus, or, at best, as it was in the early part of the nineteenth century, when the spiritless activity of species-making was its prominent feature. It is no longer merely a mass of knowledge that enables its devotees to name animals and to arrange systematically a cabinet. Zoology of to-day is vastly different; it has become one of the leading departments of science. While dealing with the structure, the development and the evolution of animal life, it at the same time brings one into contact with those changes in human opinion for which its own advances have been largely responsible.

From the group of the natural sciences there emerges into prominent place the princely science of zoology. As was said before, it is the central subject in all that advance in the knowledge of organic nature to which reference has been made. It is best fitted, it seems to me, to give

to the students in our colleges and universities an idea of the results of the activity of the nature seekers. Its sister science, botany, which runs parallel to it, deals with similar phenomena in plants. Still, it is only among animals that we find nervous responses tolerably well developed. The presence of a nervous system in animals in connection with a highly developed state of other organs affords a more comprehensive picture of vital activity. If I seem, in this statement, to show bias, it should be set down to the circumstance that my activities for some years have been taken up mainly with the study of animal life.

The observations in zoology, as carried on to-day, are so illuminating and have such important bearings that we can see why it is that all over the civilized world it has been given such a prominent place in universities and colleges. We begin to understand why great buildings are constructed for its laboratories, and why a number of men in one faculty represent different phases of zoological investigation. This is why in the State University of Iowa, as in other similar institutions, zoology has come to occupy a prominent and an honored place in the curriculum of studies.

It is the ideas of this science woven into the fabric of human thought which I have in mind, rather than merely its details. Disjointed fragments of knowledge are of little worth; they must be combined into a unity before they have much meaning. Isolated facts should be treated as merely specific illustrations of broad truths. The study of one stone in an edifice as to its chemical analysis, its resistance to strain and crushing weight, and its microscopic structure, will not give us an idea of the edifice as a whole. Thus it is that after our students have observed and experimented in the laboratory they must, under the guidance of the lecturer, be brought to see the relation of their specific observations to zoology as a science.

It is owing largely to advances in zoology that we are enabled to formulate theories about the world, the history of living beings on it, and the part they play in the scheme of nature. It is owing to the intellectual progress that zoology has chiefly promoted that we have been able to comprehend the structure of the human body and thereby to discern the means of promoting its well being and assisting in its care.

It is owing chiefly to the advances supplied by the study of zoology that one can adequately appreciate the soliloquy that Shakespeare puts in the mouth of Hamlet: "What a piece of work is man! how noble in reason! how infinite in faculty! in form and moving how express and admirable! in action how like an angel! in apprehension how like a god! the beauty of the world! the paragon of animals!"

His structure and his development excite in the mind of the anatomist the same measure of admiration and wonder. And we observe in passing that the most discerning anatomists are the comparative anatomists of zoology.

The Growth of Zoology.—Let us now look at some general phases in the growth of zoology. In its first stages of growth we find a period devoted to descriptions. In the time of Linnæus, for illustration, emphasis was placed on collecting, describing and systematically arranging all the different kinds of animals. This resulted in giving naturalists a knowledge of the form and appearance of the chief animals that inhabit the globe, and formed the basis upon which further progress could be made.

We can not, however, reach general conclusions without the examination of many facts, and there was naturally a long period devoted merely to the accumulation of facts about animals.

The next great step in advance was that of comparison. The contrast between description and comparison is brought out so clearly by I. P. Whipple in his essay on Louis Agassiz that I quote from it. He says:

> My first impression of the genius of Agassiz was gained when he was in the full vigor of his mental and physical powers. Some thirty-five years ago (now sixty-five years), at a meeting of a literary and scientific club of which I happened to be a member, a discussion sprang up concerning Dr. Hitchcock's book on fossil "Bird-tracks," and plates were exhibited representing his geological discoveries. After much time had been consumed in describing the bird-tracks as isolated phenomena, and in lavishing compliments on Dr. Hitchcoock, a man suddenly rose, who, in five minutes, dominated the whole assembly. He was, he said, much interested in the specimens before them, and he would add that he thought highly of Dr. Hitchcock's book, as far as it accurately described the curious and interesting facts he had unearthed; but, he added, the defect in Dr. Hitchcock's volume is this, that it is "dees-creep-teeve," and not "compar-a-teeve." It was evident throughout that the native language of the critic was French, and that he found some difficulty in forcing his thoughts into English words, but I can never forget the intense emphasis he put on the words "descriptive" and "comparative," and by this emphasis flashing into the minds of the whole company the difference between an enumeration of strange, unexplained facts and the same facts as interpreted and put into relation with other facts more generally known.
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> The moment he contrasted "dees-creep-teeve" with "com-par-a-teeve" one felt the vast gulf that yawned between mere scientific observation and scientific intelligence, between eyesight and insight, between minds that doggedly perceive and describe and minds that instinctively compare and combine.

The descriptive and comparative stages in zoology, of course, overlapped. It was in the early part of the nineteenth century that Cuvier, the great French zoologist and legislator, founded the science of comparative anatomy, and this brought the comparative method into the study of zoology. The beneficent results of this were notable, and zoological knowledge broadened and deepened.

In the last part of the nineteenth century zoologists added another method to the investigation of animal life; they began to study processes by the experimental method. This was not merely the extension of physiology into zoology. The new method involved experiments upon

the development of the embryo and sought to trace the modifications resulting from changes in the conditions of growth and development. It opened the way to those extensive experiments on regulation that have been engaged in by some of our American zoologists. Experiments were further extended to the study of heredity and evolution.

Thus description, comparison and experiment, came to mark different phases in the progress of zoology. Certain other nineteenth century advances can be merely alluded to. Those that had the greatest influence on the progress of zoology were the establishment of the cell theory, the discovery of protoplasm and the acceptance of the doctrine of organic evolution. If time permitted, a fuller consideration of these great events in the history of zoological science might be profitable, but I must hasten to another division of the subject.

The Idea of Service.—In these days we have come to estimate the worth of achievements in the terms of service. We hear on every hand the inquiry, How is this man or that man fitted to serve his time and generation? When inquiries come to the universities regarding one of their graduates seeking place in the world, the chief inquiry is, what is his promise of service? We do not always mean by this the narrow idea of direct utility—the faculty to make something that will sell—but more often that capacity for usefulness to the state and to society that depends on broad education, on discernment of essentials, that has been gained by freeing the mind from hereditary hindrances and from those grosser misunderstandings of natural phenomena that we class as superstitions. The university is a place where such basal training is carried on. The activity of the university is a crusade not only against ignorance, but also against superstition.

It is this kind of service for which the progress of science is especially conspicuous, and this brings us naturally to the consideration of the service of one science in particular. I wish to maintain that for the past century the progress of zoology has exercised a strong and wholesome influence upon the intellectual development of the race. The date of a century is an arbitrary limit, but the event I have in mind is the publication in 1809 of Lamarck's "Philosophie Zoologique," that contained the first comprehensive theory of organic evolution that has survived to the present day.

Very likely the idea is a novel one to many that the influence of zoology upon intellectual progress has been considerable. While one may not dissent from the proposition, he might very well wish to have it supported by specific illustrations.

Influence of Zoology on General Enlightenment.—Let us consider first the part this science has played in general enlightenment. Its influence has been great in clearing the atmosphere of thought, in dispelling clouds and in freeing the mind from the bonds of inherited prejudice and traditional superstition. At the beginning of the revival

of learning there were fantastic and grotesque misconceptions. The idea of the resurrection bone was one of these—the belief that in the body there was an indestructible bone that formed the nucleus of the resurrection body. This view was demonstrated to be untenable by Vesalius, the reformer of anatomy in the sixteenth century and the forerunner of the morphologists of zoology. Other points about the structure of man and animals, equally fantastic, were upheld, and against one who ventured to disbelieve in them the cry of heretic was raised. We may at first sight think that crude misunderstandings are harmless vagaries, but when viewed as to their consequences we see that this class of superstitions has led to intolerance and persecutions. As illustrations there come to mind the horrors of the inquisition, the cruel and harmful ideas of witchcraft, the brutal and wicked persecution of men and women for holding saner views than the majority of mankind of the part played by the Almighty in his universe. It is one of the blessings of progress that mankind has been relatively freed from persecutions of this nature. These grotesque beliefs and superstitions were dispelled by advances in the knowledge of the organization of animals. Wherever investigation in this territory prospered, it shed light and dispelled error.

From one point of view the fossil remains of extinct animals belong to the sphere of the zoologist, for the fossil animals were the ancestors of the living ones. It was two zoologists, Cuvier and Lamarck, that founded the science of paleontology, one that of the vertebrate series, and the other that of the invertebrate. When fossil bones were first unearthed they excited stupid wonder and amazement, and the most fantastic theories were proposed to account for them. They were regarded as bones of giants, as remains deposited by the deluge, etc., but finally were accepted as the remains of former races of animals and were turned to account as supplying an index to the past history of the earth. The constantly increasing collections of fossil remains of animals are enabling us to understand something of the momentous changes that have passed over the succession of animal forms that have lived upon the globe. The accounts of the discoveries of prehuman remains, connecting by gradations with races now living, are extending into remote periods our conception of the antiquity of man. These matters arouse interest and discussion, and the sweep of all these discoveries brings with it a widening of the horizon of human understanding. The historical relations of fossils have been established by a great number of talented observers. Without any disparagement to other men who have done notable work in this field, I mention but one, Henry F. Osborn, of New York, who is one of our most distinguished American zoologists. With the enormous collections at his disposal he has devoted himself with marked success to making out the relations of

fossil forms to living forms and he has succeeded in tracing the remote ancestry of a number of living races of mammals.

The Constancy of Nature.—As one great result of the investigations of the nature seekers, there was established a belief in the constancy of nature, and from the work of the zoologists in particular came the idea that all animal life is the result of one orderly progress. Animal organization leads up to the structure of the human body, and on this account there has always been a tender point in discussing the evidences as to man's place in nature.

This belief in the constancy of nature was a great step in intellectual development. In its broad application it means that the entire universe and all on it is the result of an orderly and well-directed progress. It leaves no room for the idea of chance. Remote ancestral man did not rise by chance from the animal series. The gill-clefts in the human embryo are not there by chance. Their presence has some significance, if haply we may find it. The great service of establishing the idea of orderly progress in nature is part of the heritage of work already done. The idea, in so far as it involves living and fossil forms of animals, is owing to the progress of zoology.

Some Practical Applications.—Let us now consider secondly some of the applications of zoological advances to the benefit of mankind. It was owing to the cooperation of botany and zoology that the germ theory of disease was established. The bacteria are, of course, plants. The method of studying their action on animals is zoological. There are also diseases produced by minute animal organisms, such as malaria or common fever and ague. As has long been known, this disease is due to an animal parasite that infects the red blood corpuscles. It is only within recent years, however, that the entire life history of these animal parasites has been made out. As you all know, part of their life cycle is passed in a certain kind of mosquito. The disease itself has been shown to be owing to bites of these mosquitoes, and this fact pointed out the way of avoiding malaria. The ingenuous methods by means of which the propagation of mosquitoes is prevented has freed many malarious districts from pestilence. These discoveries opened the entire question of the transmission of disease by insects, and now, thanks to those brilliant observations and experiments in which some men sacrificed their lives, we know the entire life history of the microbe of yellow fever. We know it is transmitted by mosquito bites, and that disease can now be controlled. The Roman fever, once much dreaded by travelers, and the fever of the Campagna may be avoided. Thanks also to zoological studies, these diseases no longer strike in the dark. We can recognize their approach and avoid inoculation. The scourge of the sleeping sickness that attacks the people of the Congo district is due to an animal parasite. The terrible scourge of syphilis has recently been traced to a minute organism that is probably

animal. The recognition of these facts is the first step towards gaining control of the disease.

There are other larger animal parasites like trichina, the tape worm, the filaria of the blood, etc., the life history of which is due to zoologists. Some of us recollect that the most comprehensive treatment of these is due to Leuckart, a zoologist. His "Die Menschlichen Parasiten" is a piece of research in pure science. The phagocyte theory, with all its implications, was given to the world by a zoologist—Metchnikoff.

The study of cancer, trypanosomes, opsonins, etc., are being studied by zoologists as well as by medical men, and the work of the medical men with these subjects is chiefly by zoological methods.

Studies of animal behavior, so extensively carried on by zoologists, are reacting on psychology and lighting the way to new advances in that science. Those zoological studies on the wonderful architecture of the nervous system (to which some of your men in the state university have contributed) are bringing a knowledge of the mechanism of the brain, and throwing light on its normal processes and its disorders. Leading up through these studies and the inferences to be drawn from them, we arrive at the science of comparative psychology. Furthermore the study of localization of function in definite areas of the brain substance has opened the way to brain surgery.

The studies of heredity in animals embrace many practical hints to stock breeders and to medical men.

But we can not make a comprehensive list of the large number of practical applications that come from zoological investigation. The illustrations already given are sufficient to indicate that studies in pure science often become of the highest practical value. The practical applications will follow fast enough upon the heels of advancing knowledge. The essential thing, as well as the difficult thing, is, by research, to uncover the facts and to make the first demonstrations.

Encouragement of Scientific Research.—I wish to speak just a word in appreciation of the men who extend the boundaries of knowledge, and a word in favor of the encouragement of pure research. The investigators are necessarily somewhat removed from their fellows and, therefore, often misunderstood. Theirs is a career of intense application and sacrifice. Scientific knowledge is not advanced by happy guesses in moments of inspiration, but only by continuous and well directed effort. He who would wrest from nature her secrets must prepare for the struggle by long training and must follow his calling with intense devotion. Often must he forego the pleasure of social relaxation in order that the discoveries that he is nursing into being may not suffer. When his work is reaching a climax he leads a lonely existence.

The spirit that still animates men of this type is that so long ago exemplified by Agassiz. As Whipple says:

From him came the most notable of all the maxims which illustrate the disinterestedness of the chivalry of science. At the time he was absorbed in some minute investigations in a difficult department of zoology, he received a letter from the president of a lyceum at the West, offering him a large sum for a course of popular lectures on natural history. His answer was: "I can not afford to waste my time in making money." The words deserve to be printed in capitals; but Agassiz was innocently surprised that a sentiment very natural to him should have excited so much comment. He knew that scores of his brother scientists, American and European, would have used the words "afford" and "waste" in the same sense, had they been similarly interrupted in an investigation which promised to yield them a new fact or principle. Still the announcement from such an authority that there was a body of men in the United States who could not "*afford to waste time*" in making money had an immense effect. It convinced thousands of intelligent and opulent men of business, who had never before thought a moment of time devoted to the making of money could be wasted, that science meant something; and it made them liberal of their money when it was asked for scientific purposes. It did even more than this—it made them honor the men who were placed above the motives by which they themselves were ordinarily influenced.

Men of proved capacity who are willing to devote themselves to research will enter upon it with no selfish motives. They should be classed among the benefactors of mankind, engaged in a useful service. They should be encouraged by men of wealth, by state legislatures and by the establishment of endowments to provide the means of carrying on their researches. There are men of this kind in the State University of Iowa; to the citizens of the state I would say: "These men are a valuable asset to the state," and to the university authorities I would say: "Honor these men and encourage the pursuit of graduate studies under their direction." To any in the rising generation of students who have the internal leading to follow a career devoted to scientific investigation, if they are gifted and energetic, let them without hesitation enter upon this career. The compensations will be chiefly internal. Those who enter upon scientific investigation as a life work must forego certain material prizes in the world that await equally well-directed efforts in other lines of activity, but they will have other kinds of compensations—in living close to great truths, and realizing in their discoveries that thrill of the searcher when he has found, and after long years feeling the uplift of their occupation. Nevertheless, they must learn to renounce and not be embittered as Robert Louis Stevenson wrote in that little gem of composition on the attributes of men.

To be honest, to be kind, to earn a little and to spend a little less, to make upon the whole a family happier by his presence, to renounce when that shall be necessary and not be embittered, to keep a few friends, but these without capitulation, above all, on the same grim condition to keep friends with himself —here is a task for all that a man has of fortitude and delicacy.

The Doctrine of Organic Evolution.—The crowning service of zoology in extending the boundaries of human understanding is found, perhaps, in the doctrine of evolution. The great sweep of this doctrine

makes it one of the greatest acquisitions of human knowledge. There has been no point of intellectual vantage reached which is more inspiring. It is so comprehensive that it enters into all realms of thought. Weismann, as you all know one of its great representatives, expresses the opinion that "the theory of descent is the most progressive step that has been taken in the development of human knowledge" and he says further that this position "is justified, it seems to me, even by this fact alone: that the evolution idea is not merely a new light on the special region of the biological sciences, zoology and botany, but is of quite general importance. The conception of an evolution of life upon the earth reaches far beyond the bounds of any single science, and influences our whole realm of thought."

Its applications are helping man in the knowledge of himself and his destiny. Anything that throws light on man's history and his capabilities affects the question of his duty and his destiny. A prominent theologian (Bishop Creighton, of London) has said: "Religion means the knowledge of our destiny and the means of fulfilling it." I shall not attempt to qualify the statement, as I am not a theologian, but I will point out that progress in zoology has extended the knowledge of the history of man, and has thereby influenced our conception of his relation to the universe. I think these advances are helpful, and are supplying a safer and better basis for our education, our system of morals and our religion. For all these matters of so much importance must be brought into relation with the state of knowledge at different periods of the history of our race. This condition is necessary, it seems to me, to men who think, who read or who investigate.

There is still too often a disposition shown by platform and pulpit speakers to qualify, to antagonize and to belittle scientific advances. But let us open our hearts freely, without fear, to the extensions of truth and let us continue in the belief that the knowledge gained by investigation of nature will be helpful to all departments of human endeavor and aspiration. It is to be expected that the views first of the scholars and then of the great mass of humanity will be modified and will become harmonious with all present and all future advances in knowledge.

The present results of these advances will appeal differently to people according to their temperament and experience, but to many scientific men, like Darwin and Huxley, as well as to those of smaller place, the contemplation of it all is uplifting. We may well be drawn into sympathy with the great nature psalm and feel the beauty and force of those lines of poetry in which all nature is called upon to unite in praise of the Ruling Power that directs the forces of the universe. Inanimate nature, as well as all that is alive:

> Mountains and all hills; fruitful trees and all cedars; beasts and all cattle; creeping things and flying fowls; kings of the earth and all people; princes and all judges of the earth; both young men and maidens, old men and children.

THE EMMANUEL MOVEMENT FROM A MEDICAL VIEW-POINT

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IN matters pertaining to the preservation of health, and the cure of disease, it is a fact of common observation that people in general, and educated people in particular, are very apt to seize eagerly upon every new theory or practise that is confidently announced as able to dispel their ills; and all the more eagerly if, in disregard of science and experience, it is strongly flavored with the mystical and miraculous.

The most remarkable modern instance is the extraordinary growth and acceptance of Eddyism, or so-called christian science, and so confident are its claims and so long its list of undisputed victories that they overshadow, and actually seem to make us forget, the real progress of medical science, which continues uninterruptedly, but without any such flourish of trumpets and beating of drums.

Let us remind ourselves for the moment that scientific investigation has established the presence in the world of certain poisons, whose effects on man have been carefully studied and can be confidently predicted, like strychnia, prussic acid, arsenic and opium; that it has furthermore discovered certain other poisons in the animal world, like the bacillus of tuberculosis, of anthrax, of cholera, of diphtheria, the plasmodium of malaria and the spirochæte of syphilis, equally poisonous to man with the mineral and vegetable poisons, and capable of producing equally definite and specific effects.

It may not have been part of the intent of creation that man should be harassed by the latter any more than by the former; but the conditions of life and of civilization have made us very vulnerable through our appetites. Intended or not, these specific causes of disease are here; and medical science has not only demonstrated their existence, but has further proved beyond cavil that by their isolation and exclusion the diseases which they cause may be limited, and even be prevented from spreading from person to person.

Scientific medicine has further shown that the vital parts of our bodies are subject to certain degenerative changes induced by exposure, by imprudent habits of eating and drinking, by unnatural modes of living, by inheritance, or simply by age itself. Such are the degenerations of the brain, the heart and blood vessels, the liver, pancreas and kidneys; conditions which are accompanied by demonstrable changes

in the structure of these organs, are often progressive in character, and usually incapable of repair.

There is, however, a third class of diseases, which medical science has thus far been unable to classify with the infections or the degenerations; nevertheless, very real and very common, to which it has applied the term functional disorders. These present no demonstrable organic lesion, and very many of them seem to have their origin in psychic rather than in physical causes.

It is from this latter class that the superstition and quackery of all ages have largely derived their support. To be sure, science is gradually invading even this field, and finding a physical basis for conditions which it has been hitherto unable to classify.

It is clear, however, to scientific men that there is a large class for which no physical basis is likely to be found, which will always be the subject of much philosophical speculation and mysticism. Of late, a most interesting attempt has been made to employ science, religion and hypnotic suggestion, under the guise of psychotherapy, in the study and treatment of these cases, and I thought that perhaps it would be interesting to look for a few moments at the so-called Emmanuel movement from a medical viewpoint.

The underlying principle of mind or faith healing is by no means new; it is probably as old as the race. It is the same principle that underlay the sacrificial offering of the ancients, and that underlies the pilgrimages to Lourdes, and the shrine of St. Anne de Beaupré. One of the earliest analogous movements, to that of which we now hear so much, was that of Mesmer in the latter part of the eighteenth century.

"By the discovery of a universal fluid, in which life originates, and by which it is preserved, and by the power of regulating the operations of this fluid"—he claimed to be able to cure the most intractable diseases; and although a scientific commission, including our own Benjamin Franklin, was appointed to investigate his claims, and reported that they could find no evidence of any such fluid or special agency emanating from him or his baquet, while, if blindfolded, his patients proved susceptible to its influence only when they believed that they were within its influence, whether they really were or not; still it had for many years an astonishing vogue and following.

In the hands of his pupils animal magnetism, or mesmerism, as it was called, was found to be capable of producing a state of profound insensibility in some individuals and a state akin to somnambulism in others. The subjects were made to do all sorts of unnatural things, and to endure the severest pain without flinching. A number of surgical operations were performed upon patients, who were placed under its influence, and it was the subject of much medical speculation and discussion.

But so thoroughly tainted with fraud was it found to be, in the extravagant and unwarranted claims of its practitioners, that it soon fell into the hands of charlatans and traveling showmen, and thus into general discredit.

It had, however, a great influence in the development of spiritualism and also of hypnotism, although the latter did not obtain its first scientific recognition until many years later, through the work of the eminent French neurologist, Charcot.

This same doctrine of the susceptibility of the individual will to the influence of suggestion or authority is the very foundation of christian science. It underlies the time-honored and well-nigh universal use of the placebo by the medical profession, like the historical brown-bread pill of Dr. Jacob Bigelow, and is the curative agent in most of the well-known proprietary medicines. It is reflected in that old French saying that medicine sometimes cures, often relieves and always comforts.

Physicians have always made use of it, and especially the now much-neglected family doctor. His intimate knowledge of the heredity, habits, social and domestic life of his patients gave him a peculiar advantage in discriminating between their mental and their physical ailments; while the confidence, nay, almost reverence with which his families regarded him gave an authority to his counsel that was seldom questioned.

"His father was here before him," Mrs. Macfadyen used to explain, "atween them, they've had the countyside for weel on tae a century; if MacLure disna understand oor constitutions, wha dis a'wud like tae ask?"

And this simple faith has given the country doctor his one opportunity through all the world, and for many hundreds of years, to practise what we now call psychotherapy. Perhaps he did it unconsciously and in an amateurish sort of way, as Dr. Cabot says, but he did it, is doing it and has done it with great success.

The use of psychotherapy, or mind cure, in a purely scientific way, in the practise of medicine has been tried with conspicuous success for many years by Dubois, in Berne, and Bramwell, in England. "Our endeavor," says the former, "is to raise up these patients, to give them confidence in themselves, and to dissipate their fears and autosuggestions." They do this by making a direct appeal to the patient's reason, by trying to train his will, by trying to make the dominating idea of his ego one of health and strength, not of weakness.

Another factor in the development of this new movement is the renewed interest in the old command, to love thy neighbor as thyself; the awakening of a sense of responsibility of the more fortunate for the less fortunate, in the world they both live in.

One of the striking features of our economic development is the disappearance of the small community and the small business, with the personal interest of each in all, employer and employed; and in its place we see the herding together of great masses of people in our large cities, each class by itself; the corporation taking the place of the individual owner, and the growth of vast business enterprises, with its inevitable loss of personal interest and sense of personal responsibility.

The old relation of the physician to his patient has also changed; partly because of the growth of the specialties, partly from the growth of the hospital and dispensary, where the great number of patients makes an investigation into each one's individual circumstances and surroundings easier to neglect than to follow up; but more largely still, to that want of intimate acquaintance and the mutual confidence bred of intimate acquaintance incident to life in a large community.

To meet this problem and to help the less fortunate, who, as a class, suffer most from this change, we have the growth of settlement work, of personal service, the better administration of charities, the getting closer to the personal life of the unfortunates, with a better knowledge of their trials, hopes and disappointments, giving more advice, counsel, sympathy and practical help and less alms.

We have, of course, a class of nervous invalids, whose condition is the result of the strain of business and pleasure; but another, and much larger class, whose condition is due to ignorance, misfortune and actual hardship. Hospital men are beginning to recognize that simply a thorough physical examination with a prescription for some medicine and a few hurried words of advice are not enough; that much of our effort and of our hospital endowment has been wasted, because we did not know anything about the conditions under which our patients lived; did not know whether our advice could be followed or not and, even if it could, did not follow them up, see that they understood it and that the instructions were carried out.

> To order for one patient a diet that he cannot possibly procure; for the next, a vacation that he is too poor to take; to forbid the third to worry, when the necessary cause of worry remains unchanged; to give the fourth directions for an outdoor life, which you are morally certain he will not carry out; to try to teach the fifth (a Jewish mother) how to modify milk for her baby, when she understands perhaps half what you say and forgets most of that half;—this makes a morning's work not very satisfactory in the retrospect to anybody.

We see at once the necessity of getting back to the old idea of the physician, as the friend, adviser and guide of his patients; to a closer personal relation between physician and patient, and where, as in a large hospital clinic, this is impossible, an organization which, under his direction, shall follow his patients to their homes, see what is

possible to be done in the way of carrying out his instructions, how it may be best accomplished, and see that it is accomplished.

In this line, the work of the social service department of the Massachusetts General Hospital, under Dr. Cabot's direction, is a conspicuous example of how these reforms may be brought about.

We have referred now to two separate movements; each of which has exerted a large influence in the development of this Emmanuel movement, so-called. First, the development of a healthy suggestion from without or within, with the education of the will, by an appeal to reason, and the cultivation of a right attitude toward life and especially toward health; and, secondly, the attempt to get closer to those who, by ignorance, misfortune, heredity or wrong doing, have become victims of distorted ideas about health and disease, and are unable to extricate themselves without help.

These very real, very active movements have appealed to many churchmen as offering opportunities in which they could be useful to their fellow men; while, at the same time, they would be extending the influence of their church. The first attempt on a large scale and with a complete organization to enlist in this service was by Rev. Elwood Worcester, of the Emmanuel Church, Boston.

He began three years ago with a tuberculosis class under the personal direction of Dr. J. H. Pratt. "The treatment consisted of the approved, modern method of combating consumption, plus discipline, friendship, encouragement and hope; in short, a combination of physical and moral elements." It was like a regular hospital clinic under the direction and charge of a hospital physician, but having its headquarters not at the hospital, but at the church; and the church cooperated with its visitors and helpers.

The only new thing about it was its connection with the church organization and the opportunity thus given immediately to strengthen the moral and religious character as well as the physical constitution; there was no mysticism, nothing but rational help—and the class was very successful.

So successful was it that Dr. Worcester says:

> It convinced us, that the church has an important mission to perform to the sick, and that the physician and the clergyman can work together to the benefit of the community. Accordingly, in the autumn of 1906, we determined to begin a similar work among the nervously and morally diseased.
>
> Our single desire is to give each patient the best opportunity of life and health which our means allow. We believe in the power of the mind over the body, and we believe also in medicine, in good habits, and in a wholesome and well-regulated life.
>
> In the treatment of functional nervous disorders we make free use of moral and psychical agencies, but we do not believe in overtaxing these valuable aids by expecting the mind to attain results which can be effected more easily through physical instrumentalities. Accordingly, we have gladly availed our-

selves of the services of skilled medical and surgical specialists, who have offered to cooperate with us.

All patients are referred to these specialists first, and only those found to be suffering from the purely functional nervous disorders are admitted to the classes; this is done to avoid the objection that the employment of psychotherapy "in diseases which obviously require physical interference, may result in death through neglect"; but especially because "disorders of this nature are peculiarly associated with the moral life"—and "moral maladies require moral treatment."

The philosophy of the movement is simple; the fundamental idea is the existence in each of us of a subconscious or subliminal mind, which is a normal part of our spiritual nature and is responsible for our unconscious and automatic movements, thoughts and motives. It is this subconscious mind which responds to hypnotic suggestion, after the conscious mind has been put to sleep; but even without resort to hypnotism, one of the most important characteristics is its suggestibility, its subjection to moral influence and direction.

The functional disorders of the nervous system such as neurasthenia, psychasthenia, hysteria, hypochondria and the like, are believed to be diseases of the subconscious; caused by a dissociation of consciousness, *i. e.,* by certain portions of consciousness having become detached from the main stream.

By "psychic reeducation, utilization of reserve energy, suggestions given in hypnosis or in states of deep abstraction, there follows a reassociation, a synthesis of the dissociated state, and a return to a state of healthy mindedness." And the susceptibility of the subconscious mind to suggestion is believed to afford the means of accomplishing this.

How this is actually applied in the clinic will be understood better perhaps, if I quote directly from Mr. Powell, one of Dr. Worcester's earliest pupils and imitators.

After the discussion and the prescription of good books the patient is seated in the comfortable morris chair before the fire, which I take care by this time to have burning low—is taught by rhythmic breathing and by visual imagery to relax the muscles, and is led into the silence of the mind by tranquilizing suggestion. Then in terms of the spirit, the power of the mind over the body is impressed upon the patient's consciousness, and soothing suggestions are given for the relief of the specific ills.

In addition to the clinic at which individual treatments are thus given, there is, at Emmanuel Church, a mid-week meeting, at which, after singing and Bible reading, requests for prayer are read and answered, a short, practical address, applying the teachings of Christ to human ills, followed by an hour of social intercourse in the social room of the church. For the benefit of the doctors, ministers, social workers and others who desired to study the movement, a course of

lectures was given last summer extending over three weeks, for which a small fee was charged.

Such is, in brief, the theory of the practise of the Emmanuel movement, so-called. It attempts to relieve certain disorders, which have a mental or moral origin, by the use of suggestion, reinforced by an appeal to the patient's religious faith, and it invokes the aid of medical science to eliminate those disorders which have a purely physical organic basis. Except for this appeal for the help of science and the recognition of science which it contains, there is absolutely nothing in the movement that is new.

In the first place, these so-called functional diseases do really exist; although it is true that the class has been growing constantly smaller under the influence of scientific investigation and discovery. Still, it is also true, now, as in the middle of the eighteenth century when Dr. John Atkins wrote, that "many distempers, especially of women that are ill all over, or know not what they ail, have been cured, I am apt to think, more by a fancy to the physician than his prescription."

Every doctor is familiar with the patient whose physical ailments are quite insignificant when compared with the exaggerated importance with which his mind or imagination has invested them. Every medical man recognizes how little physical basis there is for the worry, fear, doubt and melancholy with which so many of his patients are obsessed. We all appreciate how often that symptom-complex, which goes to make up what we call the neurotic temperament, is found in cases in which the most rigid physical examination fails to reveal any indication of organic disease.

In this class we find kindred conditions, which have at different times borne a great variety of names, such as nervous prostration, neurasthenia, psychasthenia, hysteria, hypochondria, or melancholia, while in other cases we are content with the simpler definition of disturbed mental equilibrium or deviation.

It seems impossible to classify these cases accurately, because there is no really scientific basis upon which a classification can be made; and the invention of new names to define certain types is not as important or as progressive as it seems.

In speaking of these names, Dubois says: "The name neurasthenia is on everybody's lips; it is the fashionable disease. But I am mistaken, the disease is not new, it is the name by which it is known that is changed. We now designate by this name, a combination of symptoms known through all time." What we must not lose sight of is that there are diseases of the mind, or imagination, or nervous system, in which no physical deviation from the normal can be found, but which are none the less real, none the less distressing, and that they tax the skill, resources and patience of the attending physician almost to the breaking point.

Furthermore, it must be observed that these are the cases in which psychotherapy, whether practised by means of the placebo, or through the agency of christian science, or the Emmanuel movement, is pre-eminently successful.

In the second place, if we study carefully the causes of these conditions, we shall find them in the two great classes into which Charcot has divided them. "The neuroses," he says, "arise from two factors, the one essential and invariable, neuropathic heredity; the other, contingent and polymorphic, the provoking agent."

In the latter belong our doubts and fears and worries, as well as the other more easily controlled factors in the causation of these purely functional nervous disorders. But even in the case of heredity, it is more the unstable nervous equilibrium that is transmitted than the specific form in which it is manifested in any individual case; and this unstable equilibrium is capable, in no small degree, of being influenced by reeducation along the lines of which we have been speaking.

"In neurasthenia," says Dubois, "we find general debility; sometimes it is physical, sometimes intellectual, but above all it is moral." In other words, it is a wrong view-point, a weakness of the will power of the individual, an inability to throw off the unduly insistent habit, or thought, or motive.

In a few words, Carpenter explains the long list of epidemic delusions of history, the form of which has changed from time to time, although many of their characteristics have been common to all; such as mesmerism, magnetism, spiritualism and the like, by saying that "The condition which underlies them all is the subjection of the mind to a dominant idea."

The trouble is that in the case of these delusions, as well as in the case of the neurasthenic, the dominant idea is pointed in the wrong direction; and the Emmanuel movement simply aims by a process of reeducation through suggestion, autosuggestion or, if necessary, hypnotism, to change this direction.

In the treatment of these cases of functional disorder of the nervous system, doctors, psychologists and Emmanuelists, all agree in attempting to continue the subjection of the mind to a dominant idea; but try, each in his own way, to make that idea stand for health, for right living and right thinking, for cheerfulness, in a word, so to direct it that it shall always look for the doughnut, not the hole.

But, while agreeing thus far, a fundamental difference of opinion is disclosed, as soon as we take up the question as to by whom this work can best be done; by the doctor or by the clergyman. The lines, however, are not strictly drawn between the two professions, because some medical men see no impropriety in asking and encouraging the assistance of the church, while many churchmen deprecate the entrance

of the church, as an organized body, into new and untried and disputed fields of activity.

One thing should be clear at the outset, and it is emphatically set forth in the introduction to Dr. Worcester's book.

The church should not undertake this work without the cooperation and assistance of the best possible medical advisers. It is a scientific work, based on the knowledge derived from the study of medicine and psychology, and its favorable results are not miracles, to be exploited for the glory of religion. They can be obtained only in cases in which no organic pathology is found to exist, in cases carefully selected, after rigid and strictly scientific examinations.

Remember that the goal is reeducation into right habits of thinking and living; and in this process of reeducation, judged by their results, there is little to choose, between the efficiency of the agnostic Dubois and the ecclesiastical Worcester.

That this process of reeducation can not be accomplished by hypnotic suggestion is the firm belief of the medical profession, especially the neurologists. That a state of hypnotic susceptibility can be induced in most people by a will that is stronger than their own is not doubted; but that it is safe, or that its results justify its use as a therapeutic measure, is stoutly denied.

Hypnotism has been known since Braid in 1842, and every now and then it rises up on a new wave of interest and popularity, often in a new guise; but so far as its therapeutic value is concerned, we have as yet derived from it no safe practical assistance.

If not by hypnotism, then how shall we seek to accomplish this re-education—shall it be by an appeal to reason, or to faith? Unless by faith is meant religious faith, it has been and will always be done by medical men, acting through both agencies; by strong men, confident in their own powers, and able to impress others with the same confidence and faith in the truth, sincerity and accuracy of their opinions.

Examples of this use of psycho-therapeutics have been common enough in the practise of every successful physician. That he has been working at an increasing disadvantage is probably true; due partly to the growth of specialism, and also to the complexity of modern life, which, as has been already indicated, means the loss of that personal relation and sympathy between patient and physician which used to be common; but to an even greater extent is this disadvantage the result of the extraordinary development of the more material and scientific side of disease.

For example, Dr. Cabot complains, and with too much reason, that the psychological side of tuberculosis has been largely disregarded. "We have tried to have our patients live almost by bread alone—actually by milk and eggs alone, in some cases.

The effect of idleness upon the will, of a discouraging and unlovely health resort on the spirits, of an empty outlook for the future—all these have been largely disregarded. Put him in the open air, and fatten him up, we say,—so far, so good. But he has a mind, as well as a body; a future, as well as a present—and neither element can be neglected."

Then, too, the study of the treatment and means of prevention of the infections and degenerations, and the brilliancy of its results, have tended to make us impatient with the less prompt response of the neurotic. We medical men have been tempted to speak sternly, as did the King in Alice in Wonderland, who told the poor hatter, who was trembling before the throne: "Don't be nervous, or I'll have you executed on the spot." So we have been tempted to say to the unduly nervous patient: "You are not sick; don't be nervous, or you'll make yourself sick"—good advice, but, like much that we have to listen to, badly given.

We must look deeper into the causes of the nervousness, and suggest something to take their place. The profession is already awakening to this defect in its practise, and one of the benefits of christian science and the later movement is the stimulus which it has given the medical profession, to take up again, in its new light, a work which it always used to do, and which still is a part of its duty; a part of its very *raison d'être.*

A recent editorial in the *Boston Medical and Surgical Journal* says:

That the profession at large needs instruction in the practise of psychotherapy we are willing to admit; we believe that such instruction should be given at medical schools, to the end that the limitations as well as the possibilities of mental treatment should be laid down, so far as our present knowledge permits.

The University of Wisconsin has already established a chair of psychology and medicine; the Phipps fund of $500,000 will soon be available for a similar course in the Johns Hopkins University, and Dr. Morton Prince offers a course in psychotherapy this winter at the Tufts Medical School. In the great field of hospital and dispensary practise much has been accomplished in the same direction by the introduction of the social-service department, as at the Johns Hopkins, the New York Post-graduate and the Massachusetts General Hospitals.

From these considerations I think there can be no doubt but that the doctor has, can and ought to do this work; the next question is, in how far it can and ought to be done by the church. We all agree that the underlying causes in very many of these functional nervous disorders are moral causes. We all recognize the strong religious side in human nature. We have all seen in our own experience, or that of some of our friends, the peace and satisfaction of mind to be derived from a strong religious faith.

It is a powerful force for the uplifting of man, mentally and morally.

This appeal to religious faith is, however, but one of our means of reaching nervous invalids; it is not always the most promising, nor is it always applicable; but it is the only one which affords any excuse for the entrance of the church into the fields of psychotherapy.

If, as has been said by one of its stoutest medical defenders, the aim of the Emmanuel Church work is only "to educate the religious faith, and to train the moral capacities of nervous invalids, sent to it by the physicians of the community for that very purpose," there would be much less room for criticism. The work would then be done in the same quiet, unobtrusive way that the medical profession believes that all such work should be done.

But when it comes to lecturing weekly, to hundreds of laymen and women at the church, and to going about from city to city explaining to lay audiences the nature of the work and encouraging imitation, as is being done by the projectors of this Emmanual idea, the medical profession at large views with alarm the superficial manner in which a complex medical problem is presented, and sees in it strong elements of quackery and charlatanism, and the danger of great harm from its practise.

Education of the reason and strengthening of the will would seem to be more promising means of securing a nervous equilibrium than an appeal to the emotions. Even though this work has been, and is being done by the general practitioner, as we have already seen, it is probably true that in many cases, at least, it is a work in which he would welcome the assistance and advice of a specialist. But how much better fitted to give that help is the expert in diseases of the brain and nervous system who has studied psychology, than he who has studied psychology alone, or taken it up as a side issue to his study of theology and of church administration.

On this point there would seem to be little chance for disagreement. The safest counselor in all medical matters is he who has first grounded himself in normal and abnormal anatomy, in normal and pathological physiology and in the theory and practise of medicine as a whole, and then upon this foundation has made a thorough and exhaustive study of his special department; not the man who has followed a post-graduate course of lectures for a few weeks, or even months, nor the man whose psychological study has been incidental to his ecclesiastical training.

To quote again from the *Boston Medical and Surgical Journal:*

> **The only knowledge which is of value in the field of abnormal psychology and mental therapeutics has been gained from the laborious investigations of psychologists and physicians. This, all are free to use; but that its use is best safeguarded, and likely to be productive of the best results, in the hands of men with a general medical training will not generally be denied.**

In sympathy with this feeling the best medical opinion is already alienated, and it is apparent that the movement must get along without the very cooperation upon which its originators laid such emphasis; yet it is doubtful if they will recognize this, for they seem disposed to show the same lack of discrimination in the selection of their medical authorities that is manifested by the opponents of vivisection.

It ill becomes a medical man to undertake to say what the effect of this movement may be on the church itself. It is entering a field that has always been occupied by medical men in an empirical way; and with the advancing knowledge of psychology and psychotherapy, they have demonstrated their ability and willingness successfully to cultivate it, wholly independent of church and religion. It is certainly not desirable that this independence should be too complete; but neither is it at all desirable, for the reasons above given, that the medical and scientific part of the work should be incidental and secondary to the religious.

The point which Dr. Worcester seems to me to miss is this: That these disorders, though not accompanied by any structural lesion, are, nevertheless, deviations from the normal brain function, and, as such, are to be studied and treated by those who have a thorough knowledge of the normal anatomy and physiology, and the pathological anatomy and physiology of the brain; and that the assistance of religion in this work, great and invaluable as that often is, should be strictly subordinate, just as it is subordinate, though very helpful and often necessary, in the conduct of the tuberculosis clinic, in his own church.

It is difficult to see where the church has any material advantage in the competition, and as the movement spreads into the hands of those with few qualifications and with greater independence of sound medical counsel, it seems not unreasonable to predict its ultimate failure and general discredit.

However, the Emmanuel movement has done good, just as the popular interest in hypnotism and christian science has done good. They emphasize and make clear the value of mental therapeutics, and spur the doctor and psychologist to renewed study of its nature, limitations and practical application. It will also serve, perhaps, to recall the practising physician from too cold a materialism; and to prevent a dehumanized scientist from taking the place of the doctor of the old school.

It is undoubtedly true that there has been a strong tendency to give undue attention and attribute undue importance to the interesting pathological problem presented in each case, and too little attention to its humanitarian aspect. We must not let the scientist push to one side the samaritan. Such is the lesson to be learned—more real human sympathy and help from the doctor, but not a "medicalized clergy."

THE ATLANTIC FOREST REGION OF NORTH AMERICA

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A Study of Influences

I

RATZEL in his illuminating work on "The History of Mankind," remarking upon the influence of the ocean on the life of primitive peoples, says:

> The wide gap which the Atlantic Ocean opens in the zone of habitation has the effect of producing "fringe"-lands. Although a brisk intercourse from north to south, together with thickly-peopled regions at the back, and more favorable climates, have rendered these far less ethnographically destitute than the regions towards the poles, we still find that in Africa the highest development has been reached on the east coast, in America on the west, that is, on the *inner* sides or those farthest from the Atlantic.

In contrast with this "gap in the belt of human habitation" the island-dotted Pacific, with its narrowing shore lines to the north, is a habitable area. Its island clusters have ever been the homes of men, and its watery waste the highway of primitive navigators. Dwellers on the fringe-lands of the continents looked out upon the Atlantic as upon a great void, and it was not until the first thousand years of the present era had passed that Scandinavian peoples penetrated its gloomy mists and founded colonies in Iceland and the Faroes. This movement of the Northmen was an expression of that migratory impulse that earlier had brought the rude peoples of Europe to the confines of the land. Five hundred years passed before the "wide gap" was again crossed.

Such a forbidding "fringe," on the farther verge of the known world, was the landfall of the first voyagers, who, steering westward, solved the mystery of the western ocean. In their wake followed successive waves of migrating peoples from the shores of Europe, who sought to found colonies on these strange coasts. Whatever fanciful Eldorados they may have pictured were rudely dispelled by the wild solitudes of an unknown forest that, sphinx-like, stretched its front along the indented coast from the St. Lawrence to Florida. Between these peoples and the world of civilization lay the dissociating Atlantic. Once landed, they had set foot on the threshold of a new home. To the natural features of this threshold—forest, mountain, river, shore-line and climate—and its aboriginal life, we must look for those influences that went so largely to the making of a new type of civilized men.

II

The natural condition of eastern North America is that of a forest-covered land. Wherever the primeval woodland has been cleared there springs up, unless thwarted by persistent tillage, a sturdy "second growth" which in time, and if allowed to spread, would restore the face of the country to something of its former appearance. We are familiar enough with such tracts, abandoned by men as unprofitable for cultivation and left to the genial influence of birds and winds and the chemistry of humus soils—nature's way of getting back to original conditions. These delectable places are the "woods," scattered in patches of greater or less extent throughout the farming districts, covering the slopes of hills and the windings of valley streams—places of little value in the economic eye save for a few cords of firewood or as a trifling source of timber, but rich withal in youthful associations.

The primitive Atlantic forest was, for a space of three hundred years after the discovery, a dominant feature in the history of the country. For a long period its impenetrable solitudes limited the spread of settlement to a narrow seaboard margin; only the more intrepid of the newcomers plunged into its depths to meet with strange adventures. The valleys of the larger rivers formed natural highways into the interior of this forest region and the broad tracts of rich bottom-land gradually became, in favorable situations, the sites of settlement, widely scattered at first, but advancing farther and farther inland as population increased.

It is hard for us, dwelling in the long-settled land, to appreciate the attitude of the early colonists toward the forest. Fear mingled with curiosity was undoubtedly the chief state of mind of the first comers. Clearing the land had a twofold purpose—for planting ("plantation" was the word used in all early writings concerning the colonies) and to satisfy a feeling of domesticity that was ingrained in the European mind—an inherited instinct to civilize. To these people the forest was a dreadful reality (some early writers speak of it as a "Desert"), full of unknown terrors, and, especially to the Puritan and Jesuit, a haunt of the Powers of Darkness. On the whole the French settlers took more kindly to the forest than did the Anglo-Saxon peoples, who from the outset evinced a ruthless determination to clear the land. The ancient wood steadily receded, slowly at first, then rapidly as the planted country widened its borders, forest everywhere giving way to field, and with it vanished much that was aboriginal.

III

"Pine-tree State" and "Pine-tree Shilling" were terms of no empty meaning in the region where they originated. In northern New England the white pine is still the most characteristic tree over wide areas of unimproved land, and a well-defined "pine belt" reaches

from the coast westward to beyond the Great Lakes. A goodly number of other trees mingle with the pines in this northern portion of the Atlantic forest—basswood, elm, birch, sugar maple and ash among the broad-leaved species, and the black spruce, hemlock and cedar among conifers, but the pine everywhere gives the broadest and most pronounced feature to the woodland. This northern pine forest follows the highest ridges of the Alleghanies quite to their southern limits, conspicuous in the mountain landscape as an evergreen belt—the hemlock (or what is left of its once grand forests after the axe of the lumberman and "bark-peeler") predominating in certain districts.

Somewhere in the mid-New England region, and in New York along the watershed of the St. Lawrence, one who travels with an eye for trees will notice the ever-increasing number and variety of broad-leaved species toward the south. Among the scattered pines appears the massy leafage of oaks, hickories, chestnuts, beeches and other hardwoods, which denotes a borderland in tree life—the northern edge of that vast deciduous forest the summer canopy of which, in aboriginal times, covered the Ohio and Mississippi basins and the Piedmont land of the Atlantic seaboard to beyond the valley of the Delaware. Even to-day there are wide areas still covered by remnants of this magnificent interior forest of the continent. And what a wealth of species! Nowhere in the temperate zone may we find such an assemblage of splendid tree forms save possibly in eastern Asia. The tall tulip tree with its gorgeous blossoms and broad leaves of shining green; the array of magnolias, rivaled in beauty and variety only in the Chinese region; the gums (both tupelos and liquidambar); the flowering dogwood; the buckeyes, locusts, catalpas, beeches, plane trees, chestnuts, ashes, elms, cherries, a great variety of hawthorns, the hackberry, persimmon and sassafras; the hickories, walnuts and butternuts; the basswood, maple and sourwood; the hornbeams, and upwards of twenty species of oaks, not to mention a host of other less familiar trees and underwoods. This is the forest that nature would spread over the land again should the white man cease in his toilsome civilization. Those of us born with a love for the woods can only regret the loss and cling the more tenaciously to every woodland tract that happily we may still have the right to protect.

On the coast plain of the southern Atlantic region another form of tree-life gives character to the forest. Here the long-leaf pine and other allied species find a congenial home, the monotonous "piney woods" covering wide tracts of level, sandy country. From the earliest times tar and turpentine have given local color to the commerce of the region where this pine abounds. In low-lying swamp districts and along river shores the bald cypress, with its curious "knees" lifted above the submerging flood, is a conspicuous tree in the landscape and entirely peculiar to this Atlantic coast region.

The existence of a forest on the Atlantic side of North America is a result of several natural conditions, chief among which is a copious rainfall. The average yearly precipitation east of the Mississippi Valley amounts to some fifty or sixty inches, increasing towards the coast and the Gulf border. This insures an abundant water supply in the subsoil—the stratum into which the roots of forest trees delve in their search for moisture. Soils, too, play their part in the foresting of a land. An underlying layer of clay holds the water, which collects above it in the permeable sands and loam of the subsoil where the tree roots interlace in a vast network. The varied nature of soils over wide regions determines, within certain limits of temperature, the character of tree growth. This explains in part the preponderance of pines on a sandy soil where the water passes more or less rapidly through the root area. Pines are physiologically dry trees as compared with the broad-leaved, deciduous species; their tough and narrow needle-like leaves do not so readily favor the transpiration process—the freeing of the water which has ascended through their vessels from the roots. What ground water enters the transpiration current is, therefore, not too easily lost to the tree through its leaves. The case of the broad-leaved trees is different, for their roots tap soils more or less constantly moist and the ascending transpiration current is quickly relieved by the broad expanse of leafage which they present to the air.

Temperature is unquestionably the controlling feature in the northward and southward distribution of trees. Along the Atlantic seaboard the effective temperatures in tree dispersal are related, in a general way, to the "lay of the land." In the same latitude various species belonging to a more northern habitat appear in the highland districts, while many southern forms are more or less abundant in the lowlands. Along its inland border the coastal plain, in many places, ends in a low rise of land, or "upland terrace," from the top of which one sees the flat expanse of the plain over many miles. Back of the observer lies the rolling country of the Piedmont district (the "uplands" of the early settlers and farming people), a landscape of hills and valleys stretching away to the eastern border of the Blue Ridge. South of the valley of the Delaware this terrace feature marks, in a very general way, the limits of certain northern and southern trees. The sweet gum or liquidambar of the southern region is abundant on the coastal plain in southeastern Pennsylvania, but is of rare occurrence on the uplands. The sheltered nature and rich alluvial soils of river bottoms extend the ranges of some of the more southern trees beyond this limit, and the same sweet gum is found growing in the valley of the Connecticut. In like manner the valleys of the Hudson, the Delaware and the Susquehanna are each tinged with a more southern tree life than are the surrounding uplands along their course. As a reverse of this picture, certain trees of a more northerly distribu-

tion, like the hemlock, are found growing along the higher land and in cool ravines as far south as the Lower Delaware Valley.

The more familiar trees, however, mingle over a wide area of country—southern New England and the Middle Atlantic district—a transition region that lies between the northern coniferous forest and the broad-leaved, summer-green forest of the great interior valley and south Atlantic slope.

Something besides temperature appears to control the distribution of certain trees. Since the settlement of the country numerous species, the natural habitats of which are far to the south, have been planted and grown successfully in more northern localities. The catalpa, the sourwood and the several species of magnolia are illustrations of this. Just what is the determining factor in preventing such trees from spreading northward (or others from spreading southward) it is difficult to say. Possibly some subtle condition in the balance of nature —some item in the struggle for existence, has helped or hindered the spread of certain trees, excluding some from localities already occupied by others. It is well known that where pines have been cut off certain species of oaks will spring up and occupy the land. The oak seedlings must have been abundantly scattered over the soil for a long period of time. Only a comparatively few species are enabled to hold their own through some superior advantage in adaptation and grow up to form a forest. A vast number must of necessity lie dormant in the soil for centuries. In Denmark, since glacial times, there has evidently been a succession of forests—oak following fir and beech following oak through a period of many thousands of years. The varied relations of the different species of trees to light, heat, moisture and soils, to animals, and to other trees and plants, are involved in slow, deep-seated processes, the expression of which is the forest as we see it. Our point of view, however, is but momentary in the vast events of nature—a fleeting glimpse, merely, of one picture in an endless biograph.

The question of the succession of forests suggests another question —that of the origin of the present Atlantic forest and its relation to other forests in different parts of the world. In a general survey of the forest trees of eastern North America there appears a large number of types which are common also to Europe. With the exception of the bald cypress and the hemlocks all the other coniferous types—pines, spruces, firs and larches—are represented in Europe by closely allied species. This is true also of a number of the deciduous trees—the oak, beech, chestnut, elm, willow, birch, aspen, walnut, ash, maple, plane tree, linden or basswood, and others are represented on both sides of the Atlantic by more or less nearly related forms. This is not surprising when we come to consider that all of the above-named trees are decidedly northern in their distribution, and exist under very similar climatic conditions. This is especially true of the coniferous

trees and the birches which form a characteristic boreal forest zone of similar features throughout the entire land area of the cold temperate region from Kamschatka to Alaska. Farther south, as the land masses diverge, the forest types show a decreasing likeness—yet the broad-leaved woodlands of oak, beech and others are readily recognized as such in both the old and the new worlds.

A number of American trees, however, and these characteristic of the more southern portion of the Atlantic forest, have no European counterparts. We look in vain through the forests of Europe for such familiar forms as the hemlock, the hickories, the tulip tree, the magnolias, the sassafras, the tupelo gums, the witchhazel, the Kentucky coffee tree, the yellow-wood, the locusts, the catalpa and the liquidambar. Strange as it may appear, nearly all of these eastern American forms occur nowhere else in the world save in eastern Asia, in the more temperate parts of China and Japan, where the same or very nearly related species are to be found. What is even still more striking is the contrast between the Atlantic and Pacific sides of North America. Excepting along the mountain crests where the more or less world-wide boreal plants find a congenial environment, the vegetation of the California region is related mainly to the dry plateau lands of Mexico and South America. So far as the trees are concerned a native of the eastern United States would find himself in much more homelike surroundings in the woodlands of temperate China and Japan than on the Pacific slope of his own country. A tulip tree, very similar to the one at home, almost if not the identical species of sassafras, numerous closely related magnolias, a near relative of the southern yellow-wood, the liquidambar, the catalpa, the coffee tree, the hemlock, and other forms appear as familiar trees in the landscape of China and Japan. This likeness between the two widely separated regions is not confined to the trees alone. The flora at large presents many features in common. The fox grape, the poison ivy, the hydrangeas, the wistaria, the blue cohosh, the may-apple, the twinleaf, the trailing arbutus or may-flower, and the creeping snowberry have each a more or less closely related form in eastern North America and eastern Asia, but are found in no other part of the world.

This likeness between the forest types of eastern North America and eastern Asia dates from a period far back in the history of northern lands. The tertiary deposits of Greenland and Spitzbergen have yielded numerous fossil remains of trees, among them a magnolia, a tulip tree, a sassafras and a liquidambar, quite similar, if not, in some cases, identical with the species now living. Besides these forms that are peculiar to the regions above named, the remains of other trees of more wide-spread distribution have been found in Greenland—a basswood, a plane tree, a persimmon, also several kinds of beeches, birches,

poplars and oaks—all of which are nearly related to the modern types.[1]

This ancient circumpolar forest flourished at a time when the climate of the Arctic regions was almost warm temperate in its character and capable of supporting a rich and varied tree-life throughout an immensely long period of time. Toward the close of this period the increasing cold which culminated in a glacial epoch caused a gradual change in the forest conditions. The more northerly portion of this wide-spread forest was not able to survive the change, its species were forced out of the region, finding more suitable conditions in lands farther to the south, where some, undoubtedly, had already established themselves. A large number of species, like the oaks and beeches and some of the conifers easily adapted themselves to a varied environment and spread widely around the north temperate zone. Others, however, found suitable conditions of life only in certain localities, often widely apart, but with similar climatic features. Here we have a solution of the similarity of tree forms in forests so widely separated geographically as those of eastern North America and eastern Asia. In every other portion of the wide region into which the trees of this polar forest migrated a certain number of species failed to occupy the soil through some adverse conditions in climate or life relations. Cut off from their center of development in the polar area, they spread to the south, but only in two localities did they succeed in establishing themselves—on the eastern side of the two great northern land masses, where almost similar climatic influences prevail.

It is of more than passing interest to thus trace back the history of our forests. As with men so with trees. Countless generations succeed one another, occupying the soil in which the remains of older generations lie buried, each new generation springing from the one before it and bearing the marks of an inheritance that allies its individual members with other men and trees in far distant lands, and that carries them back through a seemingly endless chain of life to a remote antiquity.

With the retreat of the ice at the close of the last glacial epoch, and the gradual assumption of the present climate and physical features of eastern North America, the more hardy coniferous trees, and some of the broad-leaved species that had adapted themselves to low temperatures along the edge of the ice sheet, began to occupy the newly uncovered land as a northern belt of pine forest. This expansion of tree life toward the north must have relieved the long overcrowded southern area and permitted a fuller development of the summer-green, broad-leaved forest with its great variety of forms. The deciduous habit of this summer-green forest is clearly an adaptation to a low winter

[1] "The Relations of North American to North East Asian and Tertiary Vegetation"—being portion of an address by Dr. Asa Gray, published as Article V. in "Darwiniana."

temperature, the falling away of the leaves temporarily drying out the tree by checking the transpiration current and thus preventing the disastrous effects of freezing. Along the warmer Gulf borders certain deciduous types, as the live oaks, have either never acquired the habit or have lost it since glacial times.

IV

A glamour of romance brooded over this forest land and cast its spell on the mind of western Europe. From Raleigh, dreaming of colonies beyond the sea, down to the days of the great exodus of European peoples there was a pervading sense of wonder concerning the new country. History has dealt at length with the motives that prompted whole bodies of people to leave a long-familiar and civilized homeland for an unknown and untried wilderness. No matter what the varied motives may have been—whether from religious or political oppression, or for the betterment of home and fortune—each and all were expressions of that migratory impulse that from a remote period had been working out the destiny of the race.

The English stock that colonized the Atlantic slope of North America was made up of two strains of blood that had mingled to some extent in the mother country, but which was destined to a far wider and more complete fusion in the new world. From an ethnological point of view the Welsh, the Irish and the Highland Scot or Gael have come to be regarded as the modern representatives of an ancient Celtic people that once occupied Britain and that were driven into remote corners of the land by the invading Angle and his allies. As applied to this people and its speech and literature the word "Celtic" has come to stand for a certain kind of temperament—imaginative and emotional in its nature, poetic and inclined to mysticism, a man on the edge of things, elated or cast down, and capable of great bursts of energy. The reverse of this picture is called up by the word "Teutonic"—the opposite strain of blood that has mingled so largely with the Celtic element in the moulding of an American type. In point of fact the Teutonic is the dominant strain in most of us to-day; the Celtic being more of a local infusion here and there, like the occasional brook flowing into the main stream of a river. The New England Puritans were almost wholly English Teutons and the same was true of the Virginia colonists. The Teutonic Swede and Hollander held for a time the middle region—the Hudson and the lower valley of the Delaware—and left an infusion of their blood in the dominant English population which may still be traced in certain family names. The Quakers that settled Pennsylvania were, like the Puritans, of Teutonic English stock. The Scotch-Irish peoples, likewise largely Teutonic, settled the Carolina seaboard. The main German migration spread through the middle region—in the Delaware and Susquehanna water-

sheds—and together with the Scotch-Irish settled the frontier valleys of the Blue Ridge. These were the peoples—Teutonic with a Celtic infusion—that traversed the wide gap of the Atlantic and planted a civilization on its farther fringe.

It was what these people brought with them, as qualities of mind, traditions and habits of life, and the way they looked at things, that interest us most. There could be no adaptation to a wilderness life like that of the aboriginal inhabitants of this fringe-land. Here were men and women, the product of centuries of civilization, suddenly confronted with the bare fact of existence on the edge of an inhospitable and unknown forest. This transit of civilized peoples is one of the amazing events of history. Tillers of the land for generations, they brought with them the old-world grains and food plants, their household goods, farm implements and cattle, and with these a bundle of curious ideas and superstitions which had a deep and widespread rootage in the ancestral soil of Europe. The forest held nothing for them save fuel and material for shelter. Fish, flesh and fowl were to be had in abundance, but of the wild food-plants that were indigenous to the soil and which the native peoples had used for ages these immigrants from civilization knew little or nothing. Dependent from a remote antiquity upon agriculture, it is scarcely to be wondered at that the first comers to the new land were at times sorely put to it for food, as the early records relate.

The effect of this fringe-land upon its native inhabitants was apparent in the low state of their culture. The aboriginal Atlantic tribes were unacquainted with the use of iron, which, as Ratzel has remarked, is a characteristic of all fringe-land peoples. Their agriculture was of the rudest sort—the planting of maize, squashes and tobacco, with little or no tillage, hunting and fishing producing their chief food supply. The very primitive condition of these Indian peoples was further evinced by such customs as mother-right and other ancient forms of the social state. The Atlantic fringe-land as a whole was thinly populated. Where many millions of Europeans now dwell on a sound basis of agriculture, the aboriginal population seemed barely able to hold its own, living as it were from hand to mouth. This failure to advance culturally and increase numerically through intelligent use of the soil is the underlying fact in all backward peoples, and their backwardness is, in large measure, the result of environment. Undoubtedly one of the factors in this environment is isolation, through many generations, in a forest region, though we must also remember those inherent racial traits that tend to depress whole bodies of people, relegating them to the less desirable regions—overwhelming forests, unfertile tracts and fringe-lands. A non-agricultural people can not wrest a civilization out of the wilderness. It can only be accomplished by agricultural peoples with a well developed instinct to clear

the land. The forest and the ocean set limitations to the aboriginal American. The Atlantic once crossed by the agricultural Europeans, though it served to hold them to their new home, became their highway of communication with the world. To them it was no longer "a gap in the belt of human habitation."

The Teutonic blood evinced its trait of dogged persistence in the settlement of the land. Acre after acre of the primeval woodland was cleared and planted. Of the species indigenous to the new country only maize and tobacco became rivals of the old-world culture plants. We can picture to ourselves the rude farm lands of the first period of settlement, with stumps scattered through the fields, charred and blackened in many places by the firing of the fallen growth, with the maize and the English grain springing up; the kitchen-garden of old-world vegetables and herbs; the dooryard blooms—wallflower, daffodil, marigold, larkspur, and other sweet, homely flowers brought from across the sea; the young orchards with their seedling fruit trees or newly set-out transplantings of peach, apple, plum and pear. Most of the houses at this period were built of rough-hewn logs or sawed planks, while some of the more pretentious were of stone or brick. Peter Kalm, the Swedish traveler, has left us a picture of the country-side about the Delaware in the middle of the eighteenth century, after three quarters of a century of settlement. Speaking of the farms near Philadelphia, he says in one place:

> As we went on in the wood, we continually saw at moderate distances little fields, which had been cleared of the wood. Each of these was a farm. These farms were commonly very pretty, and a walk of trees frequently led from them to the highroad. The houses were all built of brick, or of the stone which is here everywhere to be met with. Every countryman, even though he were the poorest peasant, had an orchard with apples, peaches, chestnuts, walnuts, cherries, quinces and such fruits, and sometimes we saw the vines climbing along them. The valleys were frequently provided with little brooks which contained a crystal stream. The corn on the sides of the road, was almost all mown, and no other grain besides maize and buckwheat was standing. The former was to be met with near each farm, in greater or lesser quantities; it grew very well and to a great length, the stalks being from six to ten feet high, and covered with fine green leaves. Buckwheat likewise was not very uncommon, and in some places the people were beginning to reap it.

A month later (in October) he writes:

> Wheat was now sown everywhere. In some places it was already green, having been sown four weeks before. The wheat fields were made in the *English* manner, having no ditches in them, but numerous furrows for draining the water, at the distance of four or six feet from one another. Great stumps of the trees which had been cut down, are everywhere seen on the fields, and this shews that the country has been but lately cultivated.

The "worm fence" appears to have been a feature of the farm lands in Kalm's time, at least in the middle and southern regions. He comments at some length on the wastefulness of wood in the construction of these worm fences.

Considering how much more wood the *worm fences* require (since they run in bendings) than other inclosures which go in straight lines, and that they are so soon useless, one may imagine how the forests will be consumed, and what sort of an appearance the country will have forty or fifty years hence, in case no alteration is made; especially as wood is really squandered away in immense quantities, day and night all the winter, or nearly one-half of the year, for fewel.

These rude forefathers of ours evidently had small concern for future posterity. Wood they had in abundance and they burned it without stint. The smell of the hearth smoke must have gone deep into their veins and its subtle influence still evokes a sense of homeliness in those of us who perchance have inherited some ancestral response that makes for happiness quite as much as acres of standing timber.

In New England the mantle of drift, that had been strewn over the land by the melting of an ancient glacier, afforded abundant material for the building of "stone fences." These old walls, beset with weeds and briars, became the retreat of many of the smaller wild animals that had been driven from their forest stronghold by the clearing of the land. The fox still finds a friendly road in the cover of these boundaries, and the woodchuck, ensconced within some sheltering cranny, whistles his shrill note of defiance against the harassing boy and dog.

The surroundings of a homestead very often reflect certain local conditions. The picturesque "well-sweep" still survives here and there in rural New England and its origin may possibly be traced to the long pine pole of the region. The well-sweep also appears in the pine wood tracts of the coastal plain in Delaware, and probably elsewhere. In the middle Atlantic region the "spring-house" was an early adjunct of the dairy. Many old spring-houses still linger throughout this land, with crumbling roofs and weathered walls falling slowly into decay while the rill trickles through, reminiscent of a time when pans of creamy milk and bowls of yellow butter stood cooling in its water. Ofttimes, in near-by spots, these rills and springs are choked with a growth of the pungent water-cress. Modern separator machinery has dispossessed the spring-house—only on some remote farm does it still do service. Its passing is not altogether to be regretted, for many women-folk fell early victims to the crippling rheumatism that its damp walls engendered. Occasionally some poor family makes a home in one of these abandoned structures, and this recalls a still more interesting abode which one now and then happens upon in some out-of-the-way district—an old log-house that has lingered on through the changing years, a quaint reminder of the past. I know of several such houses not many miles from Philadelphia. The spring-house appears to be altogether local in its origin; the abundant springs and rills along the hillside borders of wide meadow pastures inviting the

building of such contrivances for keeping dairy products through the hot spells of summer.

Many curious old-world customs and beliefs, into which various natural objects entered, took root in the new soils though in a somewhat altered form to suit the changed conditions. Much of folk-lore has always been concerned with the weather. Besides the ember-days there was Candlemas with its superstition regarding the sunshine on that day as a prognostication of the remainder of winter. In Germany, if the badger saw his shadow it was an old belief that hard weather would follow for some time. No badger appearing on the Atlantic slope, the rôle of weather prophet was conferred upon the ubiquitous woodchuck or ground-hog whose honors are still fairly even with the weather bureau. So prominent a bird in European folk-lore as the cuckoo appears to have had no representative in this country to take its place, though we might regard the term "rain-crow," bestowed upon its American congener, as a somewhat vague recognition of kindred qualities. The art of the divining-rod in locating underground water migrated across the sea with these early settlers, and for this purpose a forked branch of the witch-hazel was used with as sure results, when held by a gifted hand, as that of the elm, the hazel or the willow of the old world. Unfortunately we can not trace the "witch" part of the name back to any certain source in the craft of the broomstick, and "hazel" is but a borrowed title. The shrub has much about it that is peculiar. Among our American underwoods its late autumnal bloom, at the fall of the leaf, and the ripening of its fruit in the next summer are conspicuous and may have appealed to the mystery-loving mind of the seventeenth century.

Superstition gathered about the strange whippoorwill and its weird twilight call. The Indian peoples, too, seem to have regarded this bird as one of omen and Catesby in his "Natural History of Carolina" quotes a piece of aboriginal folk-lore to the effect that the bird was unknown to them until after a certain battle when a great many of their people were slain by the Europeans, and that now the birds heard calling in the dusk are the souls of their ancestors. Many fragments of nature folk-lore sprang up in the new world from an old-world transplanting, as to the belief that swallows spent the winter in the mud of ponds and river, and other beliefs quite as curious which have gone into the limbo of the forgotten past.

In parts of the country, notably in the middle Atlantic region, the planting of plane trees (the sycamore or buttonwood) in the immediate vicinity of farm houses appears to have been a wide-spread custom under the belief that the tree warded off lightning. Whatever may have been the reason for its planting, this tree, with its huge bowl uplifting a crown of branches, and the striking color of its bark—white,

brown and gray in streaks and blotches—is one of the most conspicuous features about the grounds of many old homesteads.

V.

Adventurous men who wandered beyond the Appalachian Mountains into the Ohio country found, west of the Wabash River, the forest giving place to open grassland or "prairies." These were great meadows with little or no tree growth, save along the bottomlands of rivers. The edge of the broad-leaved forest along this prairie border thinned out into those scattered, open woods known to the early pioneers as "oak openings." It may have been that this prairie country was at one time more extensively wooded and its later deforested condition a result of the persistent burning of the undergrowth by the hunting tribes of Indians to increase the pasture area for the vast herds of bison that roamed over the grass country of the Mississippi Basin. The late Professor Shaler advanced this view some years ago, stating that it was his belief that had the discovery of the continent been delayed for another five centuries much of the original forest to the east would probably have been burnt off in this way and the land changed into a prairie country. This burning of the woods seems to have been a wide-spread custom in aboriginal times. William Wood, in his "New England's Prospects," speaks of it as follows:

> For the *Indians* burning it [the ground] to suppresse the Underwood, which else would grow all over the Countrey, the Snow falling not long after, keepes the ground warme, and with his melting conveighs the ashes into the pores of the earth, which doth fatten it.

Mention is also made of this custom by numerous writers at a later period. Richard Smith,[2] of Burlington, New Jersey, who made a survey about the headwaters of the Susquehanna and the Delaware, in the spring of 1769, speaks of the appearance of these burnt tracts, and I have been told on reliable authority that in the lower Delaware region the Indians burned the tops and slopes of the hills, leaving the land along the river bottoms untouched.

The clearing of land in the progress of settlement had the same effect as the burning off of the forest—it virtually converted a wide area of primitive forest-covered country into prairie, though interspersed with tracts of woodland. Our pastures are in reality prairies so far, at least, as their faunal and floral features are concerned. This fact suggests a very interesting question. When the country was almost entirely forest-covered, as in the period before settlement, what was the manner of life of such plants and animals as now inhabit our fields and meadow pastures? Were they originally forest-dwellers which have altered their habits to meet the new conditions, or are they migrants from the western prairie country? In the case of certain birds I think that the last view embodies what has actually taken place. A large

[2] "Journal of Richard Smith," edited by F. W. Halsey.

number of plant species, however, which are characteristic of our pastures and fallow fields, involves another point of view as to their former distribution.

The aboriginal flora of the Atlantic slope was unquestionably composed of shade-loving species. Kalm, in a very interesting and suggestive paragraph in his "Travels," noted this fact as early as the year 1748. Save along the river marshes and seacoast, or in widely scattered glades and beaver meadows throughout the forest region, there was little encouragement to the growth of meadow plants as we know them to-day. A striking fact in the distribution of our eastern flora is the comparatively large numbers of species that have found their way across the ocean from the shores of Europe and have become naturalized in our fields. These immigrants are for the most part "weeds" which everywhere find congenial surroundings throughout our cultivated lands, and like the human immigrants thrive apace. They are rank growers of great fecundity and have gained an ill reputation among the farmers. Some of them, as the big white daisy and the buttercups, in out-of-the-way districts where the standard of farming is low, form the chief hay crop, and the daisy is said, by way of extenuation, to possess milk-making qualities. The names of these instruders are familiar to most of us, possibly more familiar to many than those of native growth. Daisy, buttercup, toad-flax, mullein, burdock, cockle-bur, dandelion, the common St. John's wort, self-heal, lamb's quarters, field-sorrel, smartweed, and many more are among the throng that early made a new home for themselves in the cleared land. It is hardly likely that these same plants would have gained a foothold had the land remained in its primitive forest-covered state, for they are all light-loving species, thriving in the open expanse of fields. Many indigenous species, as the Joe-Pye weeds or thoroughworts and the tick-seeds and others of more or less moist habitats have undoubtedly greatly increased their range since the days of settlement, spreading out from river borders into the low meadow lands. One interesting plant is unquestionably a rather recent migrant from the prairie country. This is the Black-eyed Susan or cone flower which has found its way into eastern fields with clover seed brought from the west.

Doubtless it was in some such manner that the host of European species that now adorn this land found a means of transit, for much grass seed and grain was brought over by the colonists. Nearly all the grasses of our fields belong to European species that have become naturalized. The native grasses appear, for the most part, to have been annual species that grew in the woods, at least in certain districts. Kalm has an interesting observation on this point. While staying with the Swedes at their village on the Delaware in the autumn of 1748 one of the old inhabitants told Kalm that in his youth "there was grass in the woods which grew very close, and was everywhere two feet high,"

but being an annual it was rapidly destroyed by the cattle, that were turned into the woods by the settlers, before it had time to seed itself. Kalm further remarks:

> However careful economists have got seeds of perennial grasses from *England*, and other *European* States and sowed it in their meadows, where they seem to thrive exceedingly well.

From the same writer it appears that the woods about this Delaware region originally had a scant undergrowth, for he speaks of their open character—"so that one could ride on horseback without inconvenience . . . and even with a cart in most places."

It is a significant fact that most of the native wild flowers of our Atlantic region, excepting those that grow along the river banks and in wet meadows, are woodland species. We go to the woods to find our early spring flowers—hepatica, bloodroot, the anemones, the mayflower, dogstooth violet, saxifrage, bluets and spring-beauty. These species probably acquired the habit of vernal blooming as a necessity imposed by their forest life—unfolding their blossoms in the sunshine of bare woods before the leafage cast its heavy shade. It is possible also that the habit may be, in part, an inheritance from the glacial time, the then short summer period of vegetative activity corresponding with our present spring.[3] In certain groups of plants which are eminently characteristic of eastern North America the larger number of species are of woodland distribution. This is the case with the golden-rods and asters. In glancing over these two groups one is struck by the preponderance of species that are found in woods or along wood borders. Those that grow in the more open lands, as in fields, are for the most part either of northern or western distribution or are inhabitants of moist soil districts, such as meadows and swampy glades.

Every boy who has indulged a natural propensity to haunt the wild and delectable spots of his neighborhood, to pursue shy birds and pry into the secrets of their nests, knows that there are some birds that dwell in the woods and others that make their homes in the fields. A student of ornithology, likewise, soon learns that certain species of birds are peculiar either to the woods or to the fields, and that the structure and habits of life in each are in accordance with the nature of the surroundings. Among eastern North American birds there are several species of sparrows, as the vesper sparrow or grass finch, the savanna and grasshopper sparrows, that are strictly grassland birds. The same is also true of the meadow lark, the bob-white, the cowbird, the red-winged blackbird, and the bobolink. These are all birds of open grassland country.[4]

[3] "The Origin of our Vernal Flora," Harshberger. *Science*, Vol. I., p. 92. New Series.

[4] These remarks on the origin of our field birds appeared in an article by the present writer under the title "Birds of the Grasslands," in the POPULAR SCIENCE MONTHLY, February, 1893.

The question naturally arises—When the region was one unbroken forest, as in aboriginal times, where were the birds that to-day are found only in our fields? Two answers appear possible to this question. There may have been a radical change in the habits of these birds since the first clearing of the land, or they may have come from the western prairie region. This latter view, is, I think, the more probable from the fact that all of the above-mentioned birds are found throughout the prairies and on the Great Plains, or are represented there by varieties which differ only in slight shades of color. The three sparrows are widely distributed over the country, though the savanna sparrow in its choice of localities is not so entirely an upland bird as are the other two species, haunting marshes along the coasts and river valleys as well as the higher open country. The familiar meadow lark of our eastern fields is abundant throughout the prairie region and is replaced on the drier western plains by a closely related form. The cowbird is another species that is widely spread over the continent and its habit of associating with cattle for the purpose of feeding upon the flies that swarm about them suggests the question—whether this habit was acquired since the settlement of the country, or did these birds haunt the bison herds on the plains and begin to straggle eastward after the cattle were introduced. The bobolink may have been a bird of the river marshes throughout the Atlantic region long before the discoverer set foot upon these shores, though from its wide range over the interior valleys and prairie lands we might infer that it had come east after the opening of the country. Similar conclusions could be adduced concerning the red-winged blackbird, but it is a bird more of marshland than of upland fields. Certain shore birds seem also to have taken advantage of the clearing of the country, as the killdeer and the grass plover, both being frequenters of plowed and fallow land.

A remarkably interesting case is that of the black-throated bunting or dicksissel. This bird is an abundant species in the glasslands of the middle prairie region. In the time of the ornithologist Wilson, and as late as the year 1880, it was not uncommon in certain localities in the east. Since this latter date it seems to have entirely disappeared from the Atlantic seaboard. For several years previous to that time I knew of a few pairs of these birds which nested each spring in certain fields of timothy and clover in the vicinity of Philadelphia. Their disappearance from these localities was remarkably sudden and apparently without reason, unless, as was suggested, it was due to the mowing of the fields and the destruction of nests and young birds. The evidence seems clear, however, that a part of the dicksissel population spread early into the newly opened fields of the east and abandoned them later, returning to their original prairie home.

In old, settled lands, as in England and the countries of western Europe, bird life has in large measure adapted itself to the human

population. Its background is the domestic landscape—village, hedgerow and park; no wide tracts of uncultivated land or of wilderness to lure birds away. In America vast numbers of birds still sequester themselves in wilderness solitudes undisturbed by men, and even in the settled districts many of the more shy species find congenial haunts in the depths of undergrowth some distance from habitations. On the other hand, there are some like the grackle or crow blackbird, the robin and the bluebird, the catbird, the chipping and song sparrows that seem to prefer to dwell about the homes of men. Indeed, it is quite true, that many of our native birds have found a certain advantage in this affiliation with the human population, at least so far as the food problem is concerned. The blackbird flocks that swarm over the corn lands in early autumn have certainly not diminished, rather have they increased, since the first days of settlement. The bobolink has probably widened its range with the increased area of cultivation. The crow, though a wary tenant of the farm lands, nesting and roosting away from the haunts of men, is still a prominent figure in the landscape of agricultural districts. Many sparrows are gleaners in the shorn fields and pastures, and about the barns and door-yards. Orchards have become a favorite resort, affording an abundance of food for numerous bird families. Great numbers of migrating birds, especially wood warblers, follow the bloom of the fruit trees from south to north in the spring to feed on the insects that infest the buds and blossoms. Not so many years ago, before the larger cities had entirely outgrown their earlier village character, the Baltimore oriole wove its hanging nest here and there in some shade tree along a busy street or in some city square or old town garden. Its rich warble and brilliant color were truly a refreshing sound and sight in the June days, a touch of the woodland life now rarely if ever to be met with in the great overgrown centers of trade.

In England one is impressed with the abundance of individuals among birds which have become dependent upon man and his work. In America a process of adjustment is going on which will unquestionably bring about a similar status in the bird population as more and more of the wild land is cleared and cultivated. In the human history of progress and discovery many delicately adjusted points in the balance of nature are disturbed, entailing often complex and widespread changes in the life and habits of the native fauna. Such changes as we have pictured are small fragments in the history of a country, but they possess great interest as showing how remotely and by what strange means causes and effects operate. Man appears in a new land, clears its face of timber and builds his home. By and by birds from the distant prairie lands find their way into his fields. The swift forsakes the hollow tree to build in the settler's chimney, and the swallow leaves the overhanging tree-trunk and rocky ledge for the shelter of the eaves

and barn. The robin nests within handreach of the door-sill, and the wren and martin, leaving their old homes in the forest to some woodpecker more lazy than his fellows, scold and quarrel for the possession of any hole or box so long as it is near the dwelling places of men.

The effect of forest clearing and settlement on the larger wild animals of the region was even more striking, since it caused their rapid disappearance from the vicinity of cultivated land. The wild animal life of the larger sort is always in inverse proportion to the increase of an agricultural population. The indigenous fauna increases in a land of aboriginal hunting folk of low culture, but decreases swiftly and surely in contact with civilized men. Aboriginal man is part of the fauna of a region. As a species he has struck a balance with other indigenous species of animals and as such is a "natural race." Like the lower animals the native man also vanishes from the region of settlement.

Of the lower mammals which inhabited the Atlantic forest region in aboriginal times the gray timber wolf was conspicuous, as all early records relate. It has not entirely disappeared from the wilder tracts, especially in the remote northern forest, even at this late day. The bear still lingers in more or less security on the outskirts of settlement, his vegetarian tendencies rendering him a far less formidable animal than some of his former neighbors. Of these last the cougar, variously known as puma, panther or "painter," was a desperate character and has been hunted out even from the more remote wilderness. His relative, the bay lynx or wild cat, may still be met with in deep mountain woods. Of the deer tribe, the common or Virginian deer ("buck" in the colloquial tongue) is fairly numerous in many parts of the wild country, largely as a result of protection. The case of the wapiti or "elk," however, is different. This great deer at one time dwelt along the wooded ranges of the Appalachians, probably in some parts extending its migrations to tide-water (upper Chesapeake Rivers) as witnessed by various local place names. The deep wilderness of coniferous forest to the north, remote and little disturbed by European invasion, is inhabited by two species of deer—the moose and the caribou —which are still fairly numerous. A difference in habits, as well as in aboriginal distribution, may account for the persistence of these two deer, as compared with the elk, in the Atlantic region. The elk is gregarious by nature and in the early history of the country was found in large herds, sometimes a hundred or more individuals, frequenting the open beaver meadows and the timber of river bottoms throughout the Appalachians. The moose and the caribou, on the other hand, rarely associate in any considerable numbers and frequent more inaccessible places, as tamarack thickets and the heavy growth of spruce and birch woods.

At the time of the discovery, and possibly long before, the bison

or buffalo had extended its range eastward into the region about the headstreams of the Ohio and Tennessee and there is evidence that an occasional straggler had even reached the upper valleys of streams flowing into the Atlantic. Remains of the animal found in caves and deposits in several localities testify to this eastward extension of its range in pre-Columbian times. The word "buffalo," occurring as it does in certain place-names of an early date throughout the middle Atlantic region, offers further evidence as to the one time presence of the animal in these localities, and there is at least one well-authenticated notice of its having been killed in central Pennsylvania as late as 1790.[5]

Of the smaller animals many, like the beaver and the otter, have disappeared, though the latter animal is still rarely seen here and there on remote streams, even in the settled districts. The beaver formerly built its dams and lodges in many of the streams throughout the forest region and traces of its occupancy may still be found in certain woodland meadows as well as in various place-names. Other species seem to have suffered little if any diminution, as the fox, skunk, mink, woodchuck, musk-rat, the raccoon and opossum, while rabbits and squirrels multiply apace. These have all in part adjusted themselves to the new conditions, many of them thriving at the expense of the agriculturist.

VI

A tract published in London in the year 1634 under the title "New England's Prospects," by William Wood, contains among other interesting and curious observations the following concerning the American weather:

> The North-West wind coming over the Land is a cause of extreme cold weather. . . . But as it is an Axiome in Nature, *Nullum violentum est perpetuum*, No extremes lasting long, so this cold winde blowes seldome above three days together, after which the weather is more tolerable, the Aire being nothing so sharpe, but peradventure in foure or five dayes after this cold messenger will blow afresh, commanding every man to his house, forbidding any to outface him without prejudice to their noses.

This is a capital description of the average winter climate of eastern North America, dominated as it is by the constant succession of high and low pressure areas moving eastward across the country. William Penn in like manner writing from Pennsylvania says—"the weather often changeth without notice, and is constant almost in its inconstancy"—which, as John Fiske remarks, is "an excellent description of nearly all weather in the United States, except on the coast of California."

Many of these early tracts on the colonies were what might be

[5] Rhoads, "The Mammals of Pennsylvania and New Jersey," page 47. Also *Proceedings of the Academy of Natural Sciences of Philadelphia*, 1895, p. 224; and 1897, p. 207.

styled in the slang of to-day "land boomers." "New England's Prospects" was one of these, and it drew a comparison at the expense of the Virginia region with the hope, no doubt, of inducing families to come over and settle. Wood says:

> Virginia having no winter to speak of, but extreame hot Summers, hath dried up much *English* bloud, and by pestiferous diseases swept away many lusty bodies changing their complexion, not into swarthiness, but into palenesse: so that when as they come for trading into our parts, wee can know many of them by their faces. . . . In *New England* both men and women keepe their natural complexions, insomuch as seamen wonder when they arrive in those parts, to see their country-men so fresh and ruddy.

In another place the same writer says:

> The hard Winters are commonly the fore-runners of pleasant Spring-times and fertile Summers, being judged likewise to make much for the health of our *English* bodies.

There has been considerable speculation on the subject of climatic influence in the moulding of an "American type." The moist climate of England presents a marked contrast with the drier continental winds of the region east of the Rocky Mountains, and a certain change in the physical type, since the settlement of the country is undoubtedly a fact. Unfortunately, however, there are no exact data and we are still left in the lurch with only our theories. No doubt the American atmosphere by virtue of the "cold wave" possesses a higher electrical potential and a more drying effect upon the tissues than does the atmosphere of Great Britain and western Europe. This may increase nerve tension, though it is by no means clear in just what way the American climate has altered the European type. The different effect of landscape, which is largely a matter of atmosphere, must have influenced the European mind in some degree, at least in accentuating the idea of greater expanse. The contrast between the sky of England and that of America assuredly is most striking. The English sky has the appearance of being less wind-swept, and the sunshine has the quality of having been sifted through cloudy vapors much more obviously than the sky in America. This has the effect of softening or toning down the outlines of the typical English landscape, at the same time making the sky seem more imminent. In the American sky there is less of this apparent nearness; more of what Lowell would call the "emancipating spaces." These landscape and sky effects, at the same time exist largely in the eye of the beholder. It seems to be a habit of mind to interpret the facts of nature in terms of one's own sense impressions—to see things, as it were, through temperamental glasses.

The early settlers found spring invading this new land—creeping up river valleys, touching the meadows and woods with its young green—and the farmer still finds spring invading this homeland of the Atlantic slope through the valleys of the Susquehanna, Delaware,

Hudson and Connecticut. Spring is always appreciably earlier in such places. It spreads later over the uplands. We are apt to think of our rivers as flowing eastward to the ocean, when in reality they flow almost directly southward. This is true, at least, of the more northerly rivers—the Connecticut, Hudson, Delaware and Susquehanna, and of the larger rivers flowing into the Gulf of Maine, as the Kennebec and the Penobscot. South of the Chesapeake the rivers do come more directly from the west.

The physical basis of this advent of spring is the northward movement of a definite line of heat (the isotherm of 43.8 degrees F.) that calls into germinal life the slumbering forces of vegetation, awakens the hibernating animal and urges the migratory bird to seek its northern nesting place. An expanding zone of green marks this creeping of the vanguard of spring up river valleys, over hill country and along mountain slopes until all the land is invaded and the frost giant driven back to his hyperborean realm. In woods almost the first touch of spring is seen when the branches of the spice-bush break out in yellow blossoms. In fields, at this time, the plow is turning over the fallow and the air is redolent of earthy smells. In gardens the sod-breaking crocus and daffodil appear along the squalid, unkempt borders. From meadow pools comes the piping chorus of cricket frogs. Crows are brooding in remote woodlands, and the grackle flocks and robins have returned. This is spring as we know it on the Atlantic slope to-day and as our fathers knew it after the first planting of the wilderness.

Spring waxes into summer and summer wanes into autumn and after the gorgeous pageant of the leaf has passed there steals over this land a time of strange stillness. A haze, like the farthest waftings of some distant forest smoke, broods over the landscape, veiling its features and filling the responsive mind with a vague sense of mystery. There is a mellowness of sight and sound; all that was harsh and discordant seems now blended into one harmonious tone by the enchanted haze. All too soon these few delightful days are dispelled and we stand upon the threshold of winter. This charming period, coming in November, has been called the Indian Summer. The reason for its name is not obvious. It suggests remoteness, like some old Celtic tale, and there are those of us who would fain think of it as a heritage from the aboriginal past. Students who have investigated the matter will scarcely credit such vain imaginings, but however the name may have come, it is surely most happily associated with a dreamy spell of weather in the late days of the American autumn.[6]

VII

The influence which this threshold of the new land had upon the mind and character of the people is perhaps more apparent than are its

[6] "The Term Indian Summer," a pamphlet by Albert Matthews, Boston.

purely physical effects upon the tissues. It is reflected in many characteristics. As a matter mainly of feeling it finds expression in literature; as a motor response, in the working out of ideals and in material progress.

A sense of spaciousness, of being untrammelled by close-set boundaries, had worked upon the imagination of the people. More than anything else was the idea of expanse in the vast extent of territory that lay to the west. The motor response to this feeling found expression in that great westward movement of population into the rich bottomlands and fertile prairies of the Mississippi Basin. Men had caught the inspiration on the threshold, amid the homely farm-lands and clearings, and in the growing towns with their semblance of European culture. Here on the threshold they felt the stir of a new life and moved under its impulse. Daniel Boone, standing on the bluff edge of Muldraugh's Hill and gazing out over the vast primeval forest that lay at his feet, is the prophetic figure of that time; a figure with its face ever turned toward the west.

The earliest feeling for the natural objects and scenery of the American land that found expression in literature appears in the stories, essay and verse of such writers as Cooper, Irving, Bryant and Thoreau, and in the journals of travelers and naturalists. In the "Episodes" which Audubon interspersed through his "Ornithological Biography," and often, indeed, in the descriptions of various birds, we find portrayed many scenes of the early American background. Thoreau was steeped in the natural features of New England and the fascination of his books is largely in the local color which he reflects through his peculiar personality. To a less extent both Emerson and Lowell have reflected this home environment of the Atlantic slope. Cooper's "Novels" emphasize the frontier life as it existed on the western edge of the threshold—the typical "backwoods" period in central New York and the northern Appalachian region. Washington Irving, for all his indebtedness to a long residence in England and to Addisonian sources, found the inspiration for much of his best work in the Hudson Valley and the Catskills. English poets and writers had set the nightingale, the skylark and the cuckoo forever singing in the hearts of men. Irving, harking back to his boyhood days, immortalized the bobolink, "the happiest bird of our spring." William Cullen Bryant, in like manner, gave literary value to many objects of native growth. To lovers of that English literature that found expression in the new homeland the "Fringed Gentian" and the "Yellow Violet" will hold an equal place in the heart with the "rathe primrose" and "daffodils that come before the swallow dares." Bryant was under the spell of the aboriginal spirit of the land, and the haunting mood of the ancient wilderness appears in many of his verses. In his poem, "The Prairies," he has given voice to that sense of dis-

tance, of vast stretches that lay "twice twenty leagues beyond remotest smoke of hunter's camp," far beyond those prairies that he was traversing and where he found the bison's "ancient footprints stamped beside the pool." Whittier, too, has left us pictures of the land—the farm life of a New England winter in "Snow Bound," and the bracing air of an upland road with its late summer bloom of golden-rod in "Among the Hills."

The most sympathetic verse of our native poets is in these touches of nature; that nature that wrought upon their childhood on hillside farms, in the woods and fields, and by the streams of the land that their fathers first set foot upon—the threshold of a new home.

LATIN VS. GERMAN

By Professor RALPH H. McKEE, Ph.D.
LAKE FOREST COLLEGE

CERTAIN arguments have from time to time been presented favoring a rule requiring all students to present Latin for entrance to college, rather than to place the ancient and modern languages on an equal footing. The following very suggestive data were obtained from the records of Lake Forest College, Lake Forest, Ill., and presented to the faculty of that institution. In the thought that others might be interested they are now publicly presented, though with some hesitation, owing to the comparative smallness of the number of students under observation, the class entering each year being ordinarily about fifty-five.

Greek and French being but rarely given in the high schools of Illinois and the adjoining states, the question actually comes to a question of German *vs.* Latin. It was thought that, by a study of the data available from the college records, evidence of the comparative value of the two languages, as now taught in the high schools, might be obtained. The statistics have given an answer showing that German is unquestionably as desirable as Latin as a requirement for entrance to college.

1. It has been claimed that the student with Latin preparation for college does better work in college than the student whose high-school language preparation has been German.

The records of Lake Forest College show that in so far as grades indicate the quality of work done in the various departments and that is the purpose of giving grades they show that the student, whose language preparation for entrance has been German presents work of *fully* as good quality as that of the student whose language preparation has been Latin.

If Latin were really better than German for preparation for college entrance, then the students of Group 1 would have the highest grades, the students of 2A higher than 2B and 2C, and the students of 3A higher than 3B and 3C. The facts are exactly contrary to the above, the students whose language preparation has been German proving to be better students than those who have presented Latin for college entrance.

2. It has been claimed that the study of Latin is particularly valuable as a preparation for work in English, far better than the modern languages.

TABLE I

ENTRANCE RECORDS AND GRADES FOR ALL STUDIES FOR THE YEARS 1903–07

Group	Years at Entrance	No. Students	Percentage of Each Grade Obtained				
			A	B	C	D	E
1.	4 Latin and 0, 1, 2, 3, 4 other language	102	34.6	42.7	21.0	1.0	0.6
2A.	3 Latin and 0, 1, 2, 3 other language	31	33.2	38.5	26.5	1.1	0.7
2B.	3 German and 0, 1, 2, 3, 4 other language	20	33.1	43.4	23.1	0.4	—
2C.	3 German and 0, 1, 2, 3 other language	10	41.2	43.2	15.5	—	—
3A.	2 Latin and 0, 1, 2, 3 other language	46	25.4	45.5	24.9	2.3	1.9
3B.	2 German and 0, 1, 2, 3, 4 other language	57	39.1	37.3	20.7	1.4	1.5
3C.	2 German and 0, 1, 2, 3 other language	29	39.2	34.1	23.0	1.9	1.9

TABLE II

GRADES OBTAINED IN THE DEPARTMENT OF ENGLISH (1903–07)

At Entrance	Percentage of Each Grade Obtained				
	A	B	C	D	E
4 Years, Single Language					
4 Latin	31.4	45.9	18.5	1.4	2.8
4 German.[1]	25.0	41.6	25.0	8.3	—
4 Years, Two Languages					
3 Latin and 1 German	12.5	12.5	62.5	12.5	—
2 Latin and 2 German	22.2	37.5	32.5	5.0	2.5
1 Latin and 3 German	No students				
5 Years, Two Languages					
4 Latin and 1 German	30.2	39.5	23.3	7.0	—
2 or 3 Latin and 3 or 2 German	43.5	43.5	13.0	—	—
6 Years, Two Languages					
4 Latin and 2 German	47.1	40.0	12.9	—	—
3 Latin and 3 German[1]	60.0	20.0	20.0	—	—
2 Latin and 4 German	No students				

TABLE III

Group	Years at Entrance	No. Students	Percentage of Each Grade Obtained				
			A	B	C	D	E
1A.	4 Latin and 0, 1, 2 or 3 German	93	34.6	42.5	19.6	2.3	1.0
1B.	4 German and 0 Latin[1]	2	25.0	41.7	25.0	8.3	—
2A.	3 Latin and 0, 1, 2 or 3 German	26	26.0	42.0	28.0	2.0	2.0
2B.	3 German and 0, 1, 2, 3 Latin	20	25.0	42.3	30.8	1.9	—
3A.	2 Latin and 0, 1, 2, 3 German	38	20.2	45.2	31.0	2.4	1.2
3B.	2 German and 0, 1, 2, 3, 4 Latin	54	31.0	45.1	20.4	1.8	1.8
3C.	2 German and 0, 1, 2, 3 Latin	26	29.3	39.7	24.1	3.4	3.4

[1] There were only two students in each of these three groups, so they should be omitted in any generalization. However, it may be noted that in their effects they balance each other.

It is thus seen that with an increase of language preparation there is an increase in the quality of the work in English, but that in so far as there is shown a difference between the value of German and Latin the advantage is with German.

Grouping the students' grades in English (1903–1907) after the method used when the grades of all departments were considered (Table I.) we have:

It might be questioned whether in group 3B the considerable number of students who have had 2 years' German and 4 years' Latin might not be responsible for the higher English grades. Omitting those with 2 German and 4 Latin we have group 3C in which it is seen that the percentage of high grades is changed but little and is still far better than the corresponding Latin group 3A.

It is thus plain that, in so far as our experience gives light, and contrary to the old superstition, a year's German helps a student's work in English more than a year's Latin.

3. Is the student whose language preparation for college is German as likely to persevere until graduation as the student whose language preparation has been Latin?

The classes of 1907 and 1908, as given in the last catalogue, were taken for study. Of these students the entrance records of 45 were available, the others having entered from other colleges, etc. At entrance these two classes numbered 95.

CLASSES OF 1907 AND 1908

	Years at Entrance. Average per Student	Years at Graduation. Average per Student	Per Cent. Increase
Latin	2.83	3.04	7.4
German	1.04	1.31	26.0

From Lake Forest's experience we must conclude that the student whose high-school language preparation has been German is more likely to stay through the college course than the one whose language preparation has been Latin.

4. It has been claimed that the students from the better class of families study Latin rather than German. It is hard to characterize just what is meant by "better class of families." Perhaps the financial condition represents this as correctly as any one criterion that may be used for measurement.

The scholarship lists for last year and this year include a total of 80 names, duplicates not counted.

	Latin	German
Average entrance credits, scholarship students	2.96	1.04
Average entrance credits, all students last five years	2.91	1.16

In other words, the more Latin and the less German a student has the more likely he is to need financial assistance.

6. It has been claimed that there are not enough students in the high schools studying German, who are not studying Latin, to distinctly increase the number of possible college students.

The Lake Forest records show that the amount of Latin per student is not increasing, but that the amount of German is steadily increasing.

Students Entering Lake Forest	Total Number	Average Latin per Student	Average German per Student
1903–4	53	2.93	1.01
1904–5	42	2.69	1.15
1905–6	57	3.21	1.33
1906–7	59	2.97	1.19
1907–8	58	2.65	1.47

The United States Commissioner of Education's Reports show that the proportion of students taking Latin is not increasing while the proportion taking German is increasing faster than that taking any other subject.

Letters of inquiry to the high schools in the larger towns of Illinois and the adjoining states show that with them the proportion studying German rather than Latin is even larger than is given in the United States Commissioner of Education's Report for those states, the small high schools being included in the Report as well as the larger ones.

Letters from other colleges where the languages are placed on an equal footing for entrance show that a considerable proportion of their students, particularly men, enter without Latin. (The colleges where the languages are placed on an equal footing are nearly all in the north central states.)

President Hughes, of Ripon College:

We have eighty freshmen. Thirty-six offered Latin for entrance requirements. Forty-four did not offer Latin.

President Plantz, of Lawrence University:

This year we have 173 freshmen, of whom 63 presented Latin as an entrance credit. I think the number presenting Latin is steadily decreasing.

Registrar Densmore, of Beloit College:

Of the class entering in September, seventy-eight had Latin credits and sixteen were without Latin credits; of the latter the large majority were men. In general, a large proportion of the men enter without Latin. I do not think that we feel that the policy of taking in these men has lowered the standard of the institution.

Registrar Hiestand, of the University of Wisconsin:

I think I may safely place the number of students with part or full Latin preparation, entering the College of Letters and Science, as between 60 and 70 per cent.

Registrar Pierce, of the University of Minnesota:

We have 548 freshmen in the College of Science, Literature and the Arts, and 131 did not present Latin for admission.

Lake Forest, while nominally requiring four years of language, two of which must be Latin, has actually not attempted to enforce the requirement of Latin, but instead has, for a number of years, placed the ancient and modern languages on a parity. By this action of its entrance board in allowing students to enter with other languages in place of Latin the above comparisons have been made possible. It is possible, though quite improbable, that the students under observation at Lake Forest were exceptional and that conclusions drawn from their records are not capable of general application. It would be very valuable, if in a community where a modern language is taught in the high school to an extent approximating that of Latin (for French, Massachusetts or New Hampshire; for German, Wisconsin, Minnesota, Pennsylvania or New York), a large institution, where the languages are on a parity regarding entrance, would present similar records.

THE LAST CENSUS AND ITS BEARING ON CRIME

By The Rev. AUGUST DRAHMS

CHAPLAIN OF THE STATE PRISON, SAN QUENTIN, CAL.

THE latest published report of the criminal census of the United States, recently issued, gives an aggregate prison population of 81,772, five hundred and fifty-seven less than a like report for the previous decade ending with the year 1890.

By states the figures present an equally exceptional showing, unexplainable upon the basis of any known law of criminal variation. Thus, among the foremost states that have shown an actual increase in the number of offenders, we have Kansas, 58.2; West Virginia, 50.6; Florida, 40.7, and Washington, 26.6. Twenty of the states, many of them under similar civic, social, climatic and economic conditions, register a marked falling off in the number of such defalcants, notably, New York leading with an actual decrease of 1,606; followed successively by North Carolina, 848; Illinois, 756; Arkansas, 589; Tennessee, 454; Alabama, 450; Arizona, 359; Missouri, 40, and California, 43 prisoners.

The above showing as a whole, would seem to indicate upon the surface a healthy diminution in crime within the last ten years, especially when we consider the fact that the general population of the country has increased during the same period 29.84 per cent. and the criminal status had grown steadily during every previous decade, as set forth by those reports successively, that of 1880, for instance, showing an increase of 78.14 per cent. over that of the previous report; while that of 1890 gives us 40.47 per cent. over that of 1880.

The cause assigned for this apparent falling off in crime, however, is set forth in the body of the report as due to the introduction and spread of the probationary system by which the more youthful, and first offenders, are placed under suspended sentences dependent upon good behavior under proper supervisoral care appointed by the court, a wise tentative measure, not without its faults, but infinitely superior to the unconditional detention of this class of offenders at the risk of a still greater immurement in crime at the most impressionable period of their existence.

As to the actual number thus passing under probationary methods we have no way of knowing save from the records of the courts themselves, but they must necessarily be considerable and help to swell materially the general criminal record.

Moreover, a large number of offenders are now sent to the juvenile reformatories who were heretofore included in the jail and penitentiary population, the number in 1890 being 14,846, while in 1904 they had grown to 32,034, an increase of 55 per cent.

These both represent decided movements in advance in the penological systems of the land, approaching more nearly a rational process in the line of treatment and certainly more in accord with the best thought in tentative methods. At least it has this advantage over the old process in that it *may* cure while the latter is *sure* to solidify irrevocably into criminal characterization.

A curious study in the variation of the criminal psychological wave that sweeps over the land, is afforded in tracing the rise and fall of the various grades of offences throughout the different geographical divisions of the United States. A wide divergence in the ratio of the same offences is thus presented with apparently slight differentiation in the social, climatic or economic conditions as manifestly operating causes.

Commencing with grand larceny, which may be considered as a representative type of crime as standing for attack upon property, and we have a wide divergence in the criminal barometer. That form of offence constitutes about 16.8 per cent. of the general bulk of offences in the United States. It finds its lowest manifestation at 12.4 per cent. in the North Atlantic Division, reaching its highest point at 27.1 per cent. in the South Central, and its medium at 15.9 per cent. in the extreme Western Division. In the report of ten years previous it found its maximum in the Western at 61.7 per cent., and its minimum (as at present) in the North Atlantic Division at 24 per cent.

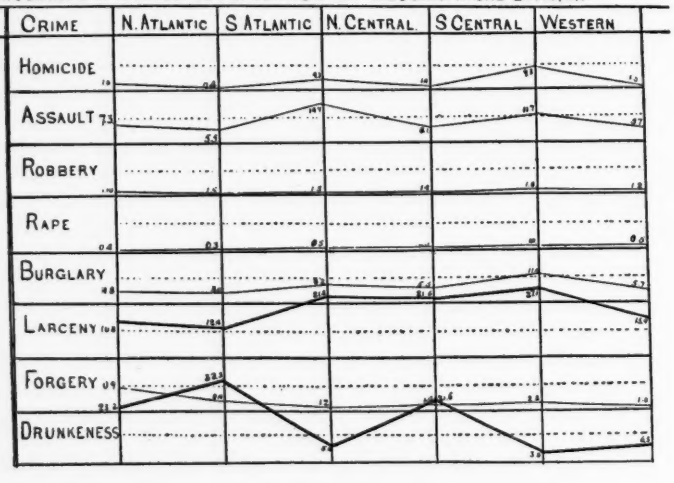
Assault, which may stand for the primitive (atavistic) form of crime in attack upon the person, and we have the lowest in the North Atlantic (5.5 per cent.), and its highest in the South Atlantic at 14.9 per cent. Burglary seems to be the least frequent in the North Atlantic (3.0 per cent.) and most rife in the South Central, where it reaches 11 per cent.

Robbery, the more aggressive form of mixed offenses, contrary to general acceptation, is least rife in the Western Division (1.2 per cent.), and most prevalent in the South Central (18 per cent.), otherwise maintaining a remarkable uniformity throughout the other geographical divisions. In the report of the previous census it reached its climax (13.6 per cent.) in the Western Division. The same may be said of forgery and rape, the latter reaching its apogee in the South Central Division (1.0 per cent.), as against a lesser showing (.05 and .03 per cent., respectively), in the other divisions.

Homicide, the atavistic element in the criminal test, runs its en-

sanguined thread through the North Atlantic Division at the rate of .04 per cent.; in the South Atlantic, 4.3 per cent.; in the North Central, 1.4 per cent., and 9.2 per cent. in the South Central, while the "wild and woolly west," contrary to the generally accepted reputation, gives us but 1.5 per cent. of homicides. It has improved in this respect since the date of the previous census (1890) which assigns to that section 27.8 per cent. and to the South Central 22.7 per cent. against its present 4.3 per cent.—a marked veering in the mercurial tendency accountable upon no known law in criminal anthropology.

PERCENTAGE OF CRIMES TO POPULATION BY GEOGRAPHICAL DIVISION.



The total number of homicides in the United States for the year 1904 is given at 10,744, as against 7,351 in 1890, an increase of over 20 per cent. during that period.

As a general rule, the excess of given offences in the southerly divisions is due to the preponderance of the negro element, 67 per cent. of minor offences being attributable to whites, and 83.8 per cent. to the negro race.

Among minor offences drunkenness adds its quota of interest to the general perturbation, oscillating from 5.0 per cent. in the South Atlantic to fever line in the North Atlantic Division at 32.3 per cent., and falling to blood heat at 21.6 per cent. in the North Central, thence to 3.8 per cent. in the South Central and gradually tapering off the mathematical debauch in 6.3 per cent. accredited to the Western Division.

The variation in crime in this respect is no indication of the frequency of the offence, however; it rather reflects the public policy of the given section as expressed in the manner and form of the punishment for this particular offence. There is no special table of the existing habits of the prisoners enumerated, hence no way of reaching

any approximate conclusion upon the basis of facts. The census of 1890 gives 23.38 per cent. drunkards among its aggregate prison population, after deducting the number whose habits are "not stated."

Drunkenness is the prevailing habit of criminal offenders, fully 50 per cent. of crimes being due to that habit in this and European countries, perhaps 20 per cent. of the crime in this country being actually committed in the saloons themselves, which are the hotbeds of the criminal propaganda.

The great bulk of crime in the United States, proportionately, is upon the side of the foreign-born population. Succinctly stated, the 13 per cent. of the whole population, representing the foreign-born element, commit 23 per cent. of the crimes in the United States. Precisely the same ratio was reported by the census of 1890. The parentage of this foreign-born element aggregates 29.8 per cent., with a mixed parentage of 6.9 per cent. as against 63.3 per cent. of native-born. The leading nationalities thus represented are Ireland, 36.2 per cent. out of a representation of 15 per cent.; Germany, 12.3 per cent. out of 25 per cent.; Canada, 10.1 per cent. out of 11.4 per cent., and England and Wales, 9.2 per cent. out of 9.10 per cent., of the whole population. As to the more recent arrivals, the Italians furnish 6.1 per cent., with 3.5 per cent. of Russians, and 3 per cent. of Poles. This foreign element is not indigenous to the soil, but belongs to old world criminalism, a form of accretion that does not help swell, but diminishes, proportionately, the list of the country whence it comes. It is characteristic of no other country in making up the criminal consensus.

A careful study of the statistics of the various states show unequivocally the vital relation crime sustains to the two great negative centers of the social disease, viz., ignorance and want. As to illiteracy, that relation is not so apparent in the present as is usually shown by the reports of local institutions. Of the 144,597 committals for the year 1904, 83 per cent. were literates, and 12.6 per cent. were given as illiterates, and 4.3 per cent. not stated. The total percentage of illiterates in the United States was 10.7 per cent.

The occupation of the prisoner is more suggestive. Over 47 per cent. of the white offenders belonged to the laboring classes and servants, and but 3.5 per cent. to the professional and clerical order, while 27 per cent. were credited to the manufacturing and mechanical trades. Among these, it is observable, the professional (to the extent of 2.1 per cent.), and the agricultural portion (to the number of 23.4 per cent.), were more addicted to major than to minor offences, while the laboring classes and servants were more prone to the lesser than to the graver forms, the temptations to the latter being much less in rural districts than in the cities. The largest proportion of offences

against the person is found in the rural sections (34.2 per cent.), while those against property predominate in the professional (40.9 per cent.) and the clerical and official (49.8 per cent.) ranks.

These figures present material for the politico-social and economic philosophers, with whom it is left to discover the true points of causal relations and to trace the relative virulence of the social disease as it approaches those great active centers where the struggle for existence grows constantly more intense. In short, the want line focuses the brunt of battle, and here, whatever specific form it assumes, the overt act (that constitutes crime) is most pronounced whether manifested under the world-old principles of greed against need, or in the more purely sporadic form, in either case the burden of the attack may be said to be committed by those who stand nearer the want end of the economic problem, hence the solution must fall more largely to the social and economic phases of the question.

No clear understanding of the criminological problem from either a concrete or academic standpoint is possible without a table of recidivists. This has been omitted from the twelfth census. It renders it valueless to the student of crime. The recidivist table is a method by which we may roughly measure (approximately) the bulk of the criminal aggression and presents the only stable criterion upon which anything like a reliable estimate of the force of the criminal disease may be based with any degree of certainty. Upon its figures alone both the protective and corrective agencies may be said to operate with perfect safety. The repeater has earned his place in the criminal category by inherent right. Recidivism is the classification in the rough by which he is assigned *sui generis*. The generalization may be crude and not always fair, but it presents the only rule possible under the circumstances. The subtler psychological conditions that underlie human conduct escape utterly any and every analytical process. Every attempted classification upon the basis of accredited conduct must of necessity be but crudely inductive, but it is the only feasible method whereby to differentiate the true criminal from the offender by circumstance.

The latter may not repeat the same act under similar conditions, his inhibitory powers coming to the rescue, the former is almost certain to do so, owing to their lack, or total absence. It is the demarcation between the instinctive and accidental malfeasant. The separation may waste some gold in the process, but in the main the method is correct. At any rate, it is necessary to a complete understanding of the criminal problem and the tentativeness of criminal and corrective measures. It clarifies the former and helps to simplify the latter. The first offender represents an invasion upon the healthy social tissue; the recidivist stands for the already diseased, hence their

treatment implies essentially different methods; to the one proper remedial initiatives under wise supervisoral care; to the latter a simple process of sequestration under practical life detention.

The latter cuts off at a single blow the fountain of criminal propagandism, protects both society and the offender himself, and is the sole remedial dispensation against the infection. If for no other reason than this, tables that present the problem in clear numerical proportion are a great gain from both a theoretical and a practical standpoint, and its omission is at the expense of both. A marshalling of figures is like the marshalling of an army, it contains the potentialities of victory or defeat, though in the absolute these may be determined by subtler factors.

SIMPLE LESSONS FROM COMMON THINGS

By Professor FRANCIS E. NIPHER
WASHINGTON UNIVERSITY

THERE has long been a feeling which is still more or less strongly pronounced, that matter is not worthy of very serious attention from mind. Some have had the feeling that matter was the source of all our woes. Although all conscious beings are embodied in masses of matter, it was thought to be a prison-house which served mainly to quench those higher feelings to which we should aspire. The world, the flesh and the devil were all put in one class, and we were advised to have as little as possible to do with any of them.

In the meantime there have been many who have given their undivided attention to the study of the material things which surround us, and with which we must deal. The chemist and the physicist have undertaken to study the structure and the composition of matter. And the more minutely it has been studied, the more wonderful does it seem when it is considered as a specimen of engineering and architectural construction. We were formerly told that the varied forms of matter which surround us were composed of a comparatively few elementary substances, each of which was composed of particles called atoms; that these atoms were all alike for the same substance, and that they exist everywhere as far as the astronomer can penetrate, into the infinite space which the stellar systems occupy. To give some idea of the size of these atoms as determined by the army of men who in various ways have indirectly measured their dimensions, Lord Kelvin made this illustration. If a rain drop were increased in volume, until its volume equaled that of the earth, the molecules of the substance being proportionately enlarged, the water molecules would then be larger than fine shot, and not larger than cricket balls.

But during the last decade another great step has been taken. A study of radioactive substances has shown that the atom itself is a structure of wonderful complexity. A radioactive substance is one whose atoms explode into their more elementary constituents. There are a number of substances which do this, radium being the most conspicuous of the group. Each of these substances yields one kind of corpuscle or particle which is common to them all. Each atom is composed in part of minute particles having a mass of about one thousandth that of the hydrogen atom. These particles have apparently been identified as negative electricity. They constitute what Franklin called the

electric fluid. They are a component of every atom of every kind of matter. We have only to rub any two unlike pieces of matter together, and one of them takes this negative fluid from the other. The piece of matter which has lost the electric fluid is said to be positively electrified. One question before us to-day is this: Should not this positively electrified matter be called positive electricity? It seems certain that there is no positive electrical fluid, and that there is no positive electrical current. What we have been calling the negative current is then the real current. It flows through our trolley wires and lights our cities. In other words, it seems very probable that all matter is composed of a combination of positive and negative electrical particles.

It is also certain that the positive and negative electrons are by no means simple in their structure. They are in some way linked with each other through the agency of the ether of space, and can act upon each other at a distance.

This may seem very complex and it may seem to be a complete overturning of the atomic theory of matter. In fact it is not in any sense an overturning of any theory of matter. The chemist still deals with atoms and combining ratios, and he will continue to do so.

If a house builder should suddenly learn that the bricks which he uses are not the final elements in his houses, it would in no way disturb him. The fact that his bricks are composed of molecules, and these molecules of atoms, and these atoms of negative and positive electricity, would in no way change his professional practise in the design of houses. The fact that we now find that every atom of any kind of matter is normally the abiding place of a certain definite number of negative electrons, each having a mass of about the one thousandth of that of the hydrogen atom, does not make these atoms behave differently from what they did before.

The fact that atoms of certain substances are exploding and giving off energy is no more remarkable than the fact that nitroglycerin and limestone behave differently. It is no more remarkable than the fact that some houses fall to pieces and give off energy. And it is in no way unexpected that an advance in our knowledge of matter has vastly increased the complexity of our conceptions of its structure. The phenomena around us with which we are in a certain sense familiar are by no means simple. For example, let us assume that some stranger from the regions which Dante described should now visit our earth, after an absence of thousands of years. When he was here before he dwelt in a cave. He sees our houses and he observes that empty houses attract homeless families. He tries to explain how this attraction is to be accounted for. He becomes acquainted with Newton's law of gravitation and he at first thinks that this is the clue which he is seeking. He soon learns that the size of the house has little to do with the attraction

which makes a family move into it. He is satisfied that houses do gravitationally attract people, but this is not in any way the attraction which produces the observed motion. He finally learns that it is the architectural features and the internal arrangement of the houses, and the landscape features immediately about the houses, which appeal to the minds of the people. Being a philosopher, he straightway forms an explanation which involves the existence of a mental field of force, emanating from these conscious beings, and laying hold of these architectural and other characteristics of the houses. Next he finds that ether waves are involved in the phenomenon. The people must see the houses before the attraction begins. This involves the existence of an all-pervading ether through which waves due to molecular agitation on the sun may pass. These waves, which we call light waves, fall upon these houses. From thence they pass into the eyes of the people, where they form images of the houses. The people do not see these images in the same sense that they see the houses, but in some unknown way these images make it possible for them to become conscious of those things, which determine for them the attractiveness of these houses.

It is through this complex train of machinery that the mental action is aroused, which results in this mental attraction. But this is not all. There must be involved in this transaction a transfer of the value equivalent of a certain number of foot-pounds of mechanical work previously done. The value equivalent of this work is produced by the family about to move into the house, and is delivered to the former owner who has moved out. This value equivalent of work is delivered in the form of a definite quantity of some valuable substance, as gold. He next finds that this transfer may also be made, by means of written entries on the books of two banks, through the agency of a check, which passes through the clearing house. By this means a credit to one customer at one bank is transferred to another customer at another bank. This value equivalent of work previously done exists potentially in the form of credit at a bank, and its quantity may be increased or drawn upon, as energy itself may be stored in a pond of water, which may be drawn upon to drive a mill.

The average citizen will tell you that we do not know what electricity is, and that the sending of wireless messages, and the driving of our street-cars, are operations which are full of mystery. But it never occurs to him that there is anything mysterious about the attraction which empty houses have for homeless families. He would think it wonderful that a balloon could be controlled by wireless methods, from a station on the earth, but it would never occur to him that there was anything remarkable about one conscious being influencing the outward action of another conscious being, by talking to him or by looking at him. We are surrounded on every hand by phenomena which we think

too commonplace to deserve a moment of our attention, and which we are, nevertheless, utterly unable to understand. In a crude way we can understand the machinery of sound waves. We can see the action of the vocal organs, by means of which they are produced. We can learn something of the nerve fibers of the ear upon which these sound waves fall. But what else is there at the two ends of this line of action? What is there within these two masses of matter, which enables either one of them to hold wireless communication with the other?

Let us assume that we are wholly familiar with the motion of each molecule of air involved in the sound waves; that we are able to make drawings of all the delicate modulations of muscular motion which are involved when the organs of speech produce these sound waves. Our drawings are to show precisely how these motions of the vocal organs are different, when English words are spoken with Irish and with German accent. Our knowledge is to be similarly complete concerning the receiving apparatus at the hearing end of the line. We trace these motions finally along nerves leading to two brains at opposite ends of the line. We may assume that we know all of these structures and their motions in the most minute detail. What do we then know of the phenomenon that one conscious being, embodied in a mass of matter, may determine or influence the thoughts and actions of another conscious being, by formulating thoughts in words, and delivering them to him through the air? How are we to explain the fact that he can plan and deliver a sentence, which will, unknown to the receiver, change the frequency of his heart beats?

He may even do this by sending to him through the mails a sheet of paper upon which he has made certain marks in ink. On the enclosing wrapper are certain other marks, images of which, by means of ether waves, are formed on the retinal membranes of clerks in the post office. By such means the muscular motions of these clerks are determined. The letter is delivered to the particular person whom the sender had in mind.

When the receiver of this paper has also allowed ether waves from these ink marks and the paper which bears them, to fall upon the nerves of his retinal membranes, he knows the mental attitude of the man who sent that paper. He makes some computations. He does some thinking. And, by the way, what is doing some thinking? He makes a response to the wireless message. The result is a mental agreement between two minds. A check and a deed of transfer of title to property are drawn, and are exchanged, and a family moves from one house to another.

What would the former cave dweller think of these amazing phenomena? I venture to assert that this transaction is vastly more complex than any electrical action. The man who talks of the mysteries of

electricity and who can not discover anything mysterious about the operations on the floor of a business exchange is in need of a mental shaking.

It is useless for us to attempt to answer such questions as, what is electricity? Or, what is a conscious being? Or, what is hydrogen? We can only answer such questions in unknown terms. But we have learned much about all of these things. Whether we consider matter in the minutest details of its structure or in the larger fields into which the telescope and the spectroscope have led us, we find the same array of wonders. How many of those who talk to us of the work of the Creator have the faintest idea of what those words mean? Have all of these electrons, and atoms and molecules and worlds and stars and stellar systems been created?

We are dependent on molecular vibrations on the sun for the conditions which make life possible. That heat energy which we receive from our sun will finally fail. The sun will become cold. The earth will freeze. Our atmosphere will become liquid and finally solid. The stars are also going through the same history. Their heat is also being continually radiated into space. The operation is like that of a clock which has been wound up and is running down. There must have been a beginning, and there will be an end, in cold and universal night. Now and then two dead stars may collide and vaporize into a nebula. This nebula may finally become a planetary system which may become the habitation of conscious beings; but it will go through the same history. And the number of bodies capable of colliding and forming world systems will have been reduced by one. To be sure, the probability of the occurrence of such collision happening during a given time interval will diminish continually, but there will evidently be an end of the present order of things. The results of recent work on the phenomena of radioactive bodies make it probable that the beginning of life on this earth may be much farther back in time than was formerly supposed. The heat which has been radiated from our earth has been in part supplied by the energy of these atomic explosions. It may be that the temperature of our sun may be thus maintained for a longer time than was formerly thought possible. But such considerations do not in any way change our ideas concerning the nature of the operations which are going on. Here also, in these radioactive bodies we find a store of energy which is being continually drawn upon. It is manifesting itself finally as heat which is being continually radiated into space. It may be that we must place a higher estimate than was formerly thought necessary upon the vast store of energy which the visible universes of to-day have possessed in the remote past. It may be that the work of creation was greater than we have supposed. It may be that the end is more remote than we now think. But even if we assent to the

conclusion that in theory the end is in the infinite future, it seems certain that so far as the possibilities of human life are concerned there will be an end. When a battery circuit is closed, the equations show that the current never reaches the value which Ohm's law demands, although it continually approaches that value. Practically it reaches that limiting value in a very small fraction of a second, and this result is also in exact harmony with the equations.

Consider the mechanical work that would be required, to take the stellar universes of to-day, as raw material, in the condition to which they are tending, and put them in the condition in which they now are.

To take a minute sample of this work of creation: let us assume that the moon were in tangential contact with our earth. How much work would be required to separate them to their present distance from each other? A very simple calculation shows that to do this amount of work would require a million steam engines, of a thousand horse-power each, working continuously for between fifteen and sixteen million centuries.

Each molecule of matter is composed of a swarm of minute particles and the chemist has never been able to detect any variations in the composition of molecules of the same material. Each molecule is a complete closed system, vastly more complex than our planetary system. What shall we think of the work which is involved in the creation of a system of stellar universes, so vast that the human eye can never hope to see any limit to its extension in space, and composed of particles existing in endless duplication, which are so small that the human eye can not hope to see them?

And we must add to these wonders of the material world, the still greater mysteries which are involved in life and consciousness. We may devote a lifetime to the study of these things, and we shall then feel how insignificant is our knowledge of these revelations which we are continually receiving. And we are more and more impressed with the feeling that a being capable of producing such results, must differ in many respects from an oriental despot. We may become more and more inspired with a feeling of profound admiration and wonder, as we think on these things which our eyes behold. But we can not feel that such a being is anxiously seeking for flattery and praise. If we were to seek by such means to secure from him personal favors which we do not deserve, we should be paying him a very doubtful compliment. Such methods are not even considered proper at our city hall.

The highest type of man of which we can conceive is one who does not deserve any credit for shunning iniquity or for doing the works of righteousness. He does not refrain from murder in order to escape the gallows and the lake that burns with fire and brimstone. He never feels any temptation to commit murder. He does not murder and he

does not steal, because he is neither a murderer nor a thief. Society does not need to surround him with policemen in order that he may be led to conclude with some reluctance and regret that honesty is the best policy! And when he goes about doing good, when he helps the fatherless and the widow in their affliction, he is not doing such deeds in order that he may secure to himself personal advantages in the nature of titles to valuable celestial properties. He thinks not of himself when his brother calls for help. He has within him the instincts of a gentleman. They were born in him. They have been bred into his very bones. These instincts prompt him to respect the rights and property of others, and to lend a hand when others need his help. He is ready to do his part in providing the children who are living amid brutal surroundings, with those influences which will inspire them with admiration for that which is pure and good and manly.

The highest type of man of which we can conceive deserves no more credit for being what he is, morally, than he deserves credit for having a white skin. It is precisely this which makes him a man of the highest type. He does not need to waste his strength in resisting temptation to do wrong. When we come to consider the character of the Creator of these wonders, which so far as we know find their highest expression in the human race, on this little insignificant earth, we can not think of him as claiming or deserving any credit for being what he is, or for doing what he has done.

We can not think of him as having been sorely tempted to do wrong and having resisted the temptation. We can not think of him as having struggled into his present position, under adverse and discouraging conditions, in a manner which entitles him to praise. We can not think of him as an oriental despot, who demands praise of his creatures, most of whom have never studied physics or astronomy or chemistry or biology, and who are therefore unable to properly appreciate the wonders which surround them on every hand.

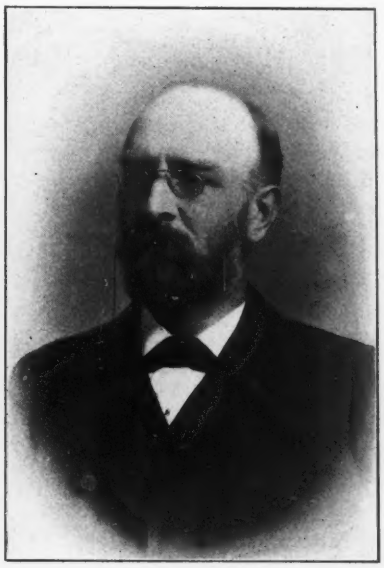
We have, however, made progress, and we can all see that the possession of such knowledge as we possess, by the masses of the people, during those dark and brutal periods of religious intolerance, would have made impossible those bloody quarrels over questions to which we give not the slightest thought.

THE PROGRESS OF SCIENCE

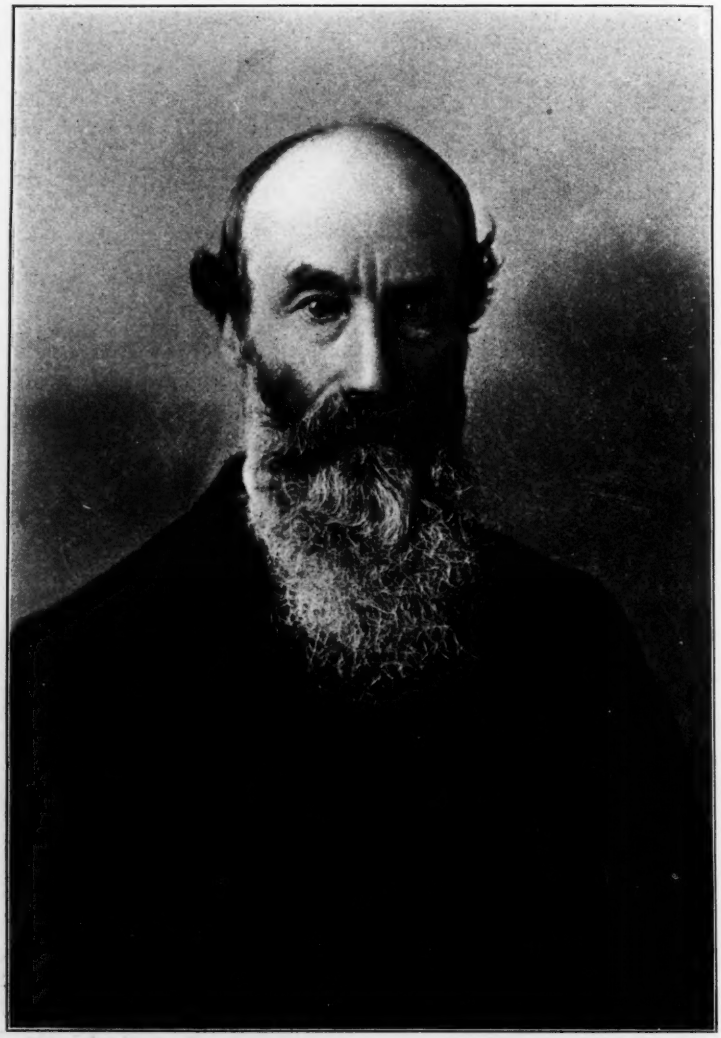
THE WINNIPEG MEETING OF THE BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

THE British Association has in recent years taken seriously its imperial duties. Twenty-five years ago it first met outside the British Islands. The step was not taken without long consideration and considerable opposition, but the meeting in Montreal in 1884 proved remarkably successful, no fewer than 910 members crossing the sea. In 1897 the association met in Toronto, and after an intervening meeting in South Africa in 1905, it has now for the third time visited Canada. The registration of members at Winnipeg was about 1,400, of whom about 500 crossed the Atlantic and about 150 came from the United States. The attendance at meetings of the British Association is always greatly increased by local and visiting associate members who join for the year from interest in the general and social events or from public spirit. The meetings of the British and American associations are of about the same size, but there is a noticeable difference in the composition of the membership. In the case of the British Association there are a large number of amateurs dominated by a few leaders, whereas at the annual meeting of our association and the affiliated societies the average working man of science is the main factor. This appears to represent a typical difference between an aristocracy and a democracy, for though Great Britain may be in its government more democratic than the United States it retains its social aristocracy.

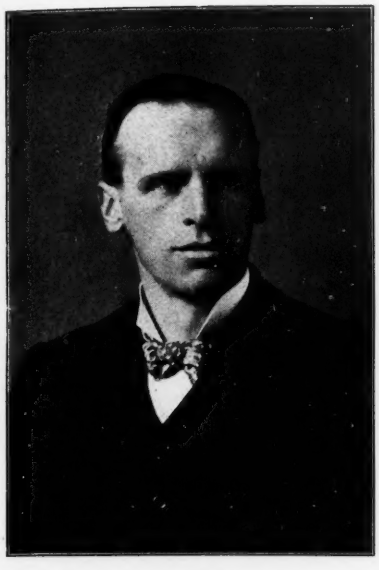
DR. A. E. SHIPLEY,
of Cambridge University, President of the Zoological Section.



DR. ARTHUR SMITH WOODWARD,
of the British Museum (Natural History), President of the Geological Section.



DR. T. G. BONNEY,
Professor Emeritus of Geology, University College, London, President of the British Association for the Advancement of Science.

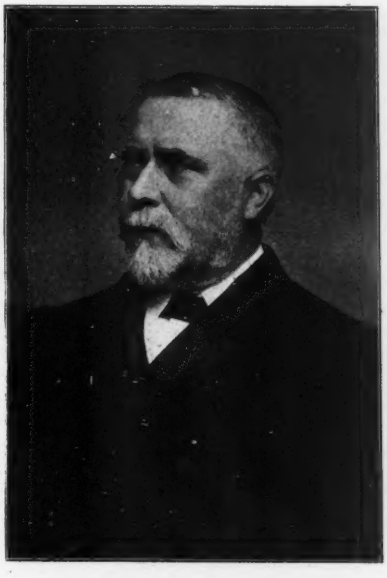


DR. E. H. STARLING,
of the University of London, President of the Physiological Section.

It is certainly a remarkable fact that with a much smaller number of working men of science than Germany or the United States, Great Britain is able to produce so many great leaders. Lord Rayleigh was president of the Montreal meeting twenty-five years ago and Lord Kelvin president of the section for mathematics and physics. It might be supposed that Great Britain could not again furnish two physicists of the same class, but at Winnipeg Sir J. J. Thomson presided over the association and Professor Rutherford over the section, both recipients of Nobel prizes and commanding the course of modern physics.

In his address Professor Thomson referred first to the local conditions of the meeting and the great development of Manitoba, reminding his hearers that even the enterprise and energy of the people and the richness of the country could not have accomplished this without the resources coming from the labors of men of science. After discussing certain educational problems, including the dangers from the examination system and early specialization, the speaker reviewed the more recent developments of physics and the new conception of physical processes with which he himself has been so intimately concerned. As he aptly said in his concluding sentences: "The new discoveries made in physics in the last few years, and the ideas and potentialities suggested by them, have had an effect upon the workers in that subject akin to that produced in literature by the Renaissance. Enthusiasm has been quickened, and there is a hopeful, youthful, perhaps exuberant, spirit abroad which leads men to make with confidence experiments which would have been thought fantastic twenty years ago."

Professor Rutherford naturally chose for discussion one of the subjects in the newer physics with which his own work—largely carried on in a Canadian university—has been concerned, namely, the present position of the atomic theory and the values of certain fundamental atomic magnitudes. Before the



SIR WILLIAM HENRY WHITE,
formerly Director of Naval Construction of the British Navy, President of the Engineering Section.

chemical section Professor Armstrong covered a wide range of topics. He charges Ostwald with filling his test tubes with ink; but he himself writes some 35,000 words, going at times considerably beyond the ascertained facts of science, as in discussing "the revolt of women against their womanhood." Dr. A. S. Woodward before the geological section treated paleontological topics and the old age of races largely in the light of American discoveries. Professor A. E. Shipley opened with some references to Charles Darwin, discussed methods of organizing zoology, with its 600,000 known species, and concluded with a discussion of international oceanic research. Sir W. H. White treated the engineering enterprises and commerce of Canada and Great Britain. Professor E. H. Starling applied physiology and biology to sociological questions. Addresses of equal interest were given before the other sections and at four general meetings, the speakers in practically all cases emphasizing those aspects of science which are likely to hold the attention and affect the conduct of those who are not professionally engaged in scientific work.

As always, the excursions and social events were arranged in a way that it does not seem possible to rival in this country. The Canadian government appropriated $25,000 and the city of Winnipeg $5,000 toward the expenses. It is only necessary to mention the excursion to the Rocky Mountains and the Pacific coast with 150 invited guests. When the association met at Montreal 300 English members attended the Boston meeting of the American Association, but there does not appear to have been this year any concerted effort to bring the foreign men of science south of the Canadian border.

The Rev. T. G. Bonney, the eminent geologist, professor emeritus in University College, London, was elected president of the association for the meeting to be held next year at Sheffield.

SCIENCE AND ADVENTURE

REACHING the North Pole and flying across the British Channel are sporting events of the first magnitude. They stir the imagination and unite the whole world in healthy interests and generous enthusiasms. They may also be regarded as achievements of applied science. Thousands of workers in the laboratory and in the field have made possible the adventures whose culmination fills the daily papers. To "nail the stars and stripes to the pole," as Commander Peary cabled, or to win for France "imperishable glory" by a flight from Calais to Dover is not in itself a serious contribution to science. But these achievements exhibit in dramatic form the conquest of nature by man which science has accomplished. Perhaps the only facts of considerable scientific interest so far announced in the case of the "dashes" to the pole are Dr. Cook's statement that he discovered land in the extreme north and Commander Peary's sounding which proved that the sea at the pole is over 1,500 fathoms deep. In the main the appeal is to the imagination and it is unfortunate that patriotic enthusiasm has been checked by a certain amount of skepticism in regard to Dr. Cook's exploit. It is certainly unfortunate that Commander Peary should have so expressed himself. From the time of Herodotus it has been the fate of travelers to have their stories questioned. It is to be hoped that Dr. Cook's records may prove entirely definite, so that all doubts may be cleared up. In any case the pole has been reached, and the way has been cleared for scientific exploration in the arctic and antarctic regions.

THE POSSIBLE POPULATION OF THE UNITED STATES

IN the last issue of the MONTHLY Professor A. P. Brigham discusses the capacity of the United States for population and places the maximum number of people that can be supported by our resources at 305,000,000. In an

earlier volume of the MONTHLY (November, 1900) President Henry S. Pritchett predicted a population of over a billion two hundred years hence and of about twelve billion six hundred years hence. We may agree with Professor Brigham that "population is a vast and wandering theme." It is, however, fascinating and not without practical interest. Emigration laws and even birth rates are not unaffected by such guesses as may be made.

The population of a country is in the main limited by the food supply. Man does not live by bread alone, but his higher needs are increasingly supplied by an increasing population. With a given stock and a given environment the number of men of genius who add to the social heritage is proportional to the population. Material supplies other than food are needed, but they are not likely to become exhausted. Metals and clays are inexhaustible; the increasing difficulty of obtaining them will surely be met by improved methods. Metals—also wood and even the materials of clothing—can be used over and over again should this become desirable. Fuel, like food, is consumed, but the sun's energy is boundless and means are already at hand to obtain all that may be needed. It is safe to say that the population of the earth is limited only by its food supply.

The area of continental United States apart from Alaska is, in round numbers, two billion acres, of which one half is in farm lands and one fourth under cultivation. Probably three fourths of the total area could be brought under intensive cultivation and made to give fifty bushels of corn per acre or its equivalent. The food value of a bushel of corn is sufficient to support a man for nearly a month, and the product of an acre would about support four men for one year. If one half of the grain were turned into animal food for human consumption, two men per acre could be fed and the country would support a population of 3,000,000,000. Apart from the possible synthetic manufacture of food, it may be regarded as probable that improved agricultural methods will in the course of a century double the present maximum productivity. It should also be remembered that tropical lands are far more productive and under an ideal civilization would export food and import manufactures. The maximum population that might be supported in the United States may, a century hence, consequently be placed at about ten billions.

Such a maximum figure compares with a probable figure somewhat as the theoretically possible efficiency of a steam engine compares with its actual efficiency. But a population of one billion could be supported comfortably. Our present food supply feeds about a hundred million. Better methods would double the production from the area at present under cultivation and less wasteful methods would halve the consumption. If the area under cultivation were increased from 25 per cent. to 62.5 per cent. there would be food for a billion people. Allowing for a reasonable exchange with tropical countries and an ever-increasing efficiency in production such a population would have an ample food supply with a reasonable amount of meat and fruit and even as much alcohol, tobacco and coffee as may be desirable for health. Such a population would not mean in any sense living under the conditions of the Asiatics. The more dense the population within the limits stated, the greater would be the per capita wealth. Nor will the country be crowded. Doubtless most of the people would prefer to live in villages or cities and for the quarter that might prefer the country there would be thirty acres for each family.

What the actual population of the United States will be a hundred years hence is a very different question. In a state of nature the number of a species may be reduced by enemies or disease, but as a rule they are limited only by the food supply. But with

man a change more significant than any other in history has taken place within the last fifty years. Thanks to the applications of science, the food supply is ever increasing; but the supply of children decreases in an ominous manner. The population of a country is no longer limited by the food supply, but by a conflict between instinct and rationalism, and by physiological fertility under the conditions of modern civilization. It is not likely that the population of any country will ever again be so large as its food supply would support.

SCIENTIFIC ITEMS

WE record with regret the deaths of Professor Emil Hansen, the eminent physiological botanist of Copenhagen, and Dr. Otto von Bollinger, professor of pathology at Munich.

DR. C. M. GARIEL, professor of medical physics at Paris, has been elected president of the French Association for the Advancement of Science for the meeting to be held next year at Toulouse.—At the celebration of the fifth centenary of the University of Leipzig some ninety honorary degrees were conferred, including a doctorate of medicine on Professor E. B. Wilson, of Columbia University, and doctorates of philosophy on Professor Jacques Loeb, of the University of California, and Professor A. A. Michelson, of the University of Chicago.—At its recent celebration the University of Geneva conferred one hundred and fifty honorary doctorates. Among the men of science included were Lord Lister, Professor Haeckel, Professor Ostwald and Professor Engler.

PROFESSOR R. C. ALLEN, of the University of Michigan, has been elected state geologist to succeed Mr. A. C. Lane, who resigned to accept a chair in Tufts College.—Dr. Juan Guitaras has consented to remain director of sanitation and chairman of the National Board of Health for Cuba, in view of the fact that the government has now appropriated sufficient funds for the work of the department of sanitation.—Dr. E. D. Durand, the director of the census, has announced the appointment of experts in statistics, economics, agriculture and manufactures to cooperate with him in the formulation of the census schedules on which the enumerators will enter the information they obtain next April. The conferees on the agricultural schedule are: Dr. J. L. Coulter, instructor in agricultural economics in the University of Minnesota; Dr. H. C. Taylor, professor of agricultural economics in the University of Wisconsin; Dr. C. F. Warren, Jr., professor of farm management in Cornell University, and Dr. T. M. Carver, professor of economics in Harvard University. The conferees for manufactures and on population are leading experts, being in most cases university professors.

WHILE the British are reorganizing the College of Medicine and the Technical Institute at Hong Kong into a university, the Germans have established a school of university grade at Kiao-chau. It is said that the German government has appropriated $160,000 for its establishment and will contribute $50,000 annually for the support of the institution.—The assembly of Iceland has decided to establish a university at Reikjavik, with four faculties and sixteen professors and lecturers.

BY the will of Cornelius C. Cuyler, the New York banker and a trustee of Princeton University, $100,000 is bequeathed to Princeton University. The residue of the estate, which is said to be very large, will go to the university after the death of Mrs. Cuyler.—The council of the city of Cincinnati has appropriated the sum of $576,000 to erect three new buildings for the University of Cincinnati.